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By C. W. Lawr

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Contents for November 2, 1929

VOLUME 128, NUMBER 18

Copyright, 1929, by McGraw-Hill Publishing Company, Inc.

Editorials 685

CURRENT TRENDS in Aviation Vitally Concern the Mining Industry . . . Metal Industry Suffers Little from Wall Street Crash . . . Sunshine Compensation for Underground Workers . . . A Radical Suggestion—and a Silly One . . . Secret Processes and the Making of Vast Profits . . . Has the Machine Increased Accidents in the Mining Industry?

Cyanide Regeneration Effects Substantial Savings at Mexican Plant .. 688
C. W. LAWR

Causes of "Rock Bursts" in Mines 692

Onyx Regularly Produced in Yavapai County, Arizona 693

Electrical and Mechanical Maintenance 694
G. J. YOUNG

Of the Race of Titans 699
ILLUSTRATIONS

Technique of Industrial Sales and Advertising Research 717
MALCOLM McGHIE

Useful Operating Ideas .. 700
Digest of Current Literature 703
Comment and Criticism .. 704
By the Way 706
Personal Notes 707
Obituaries 707
Mine, Shop and Plant 708
Mining News 710
Market and Financial News 718
Market Report 720
Mining Stocks 722
Service Directory 39
Searchlight Section 40
What and Where to Buy 44
Advertising Index 48

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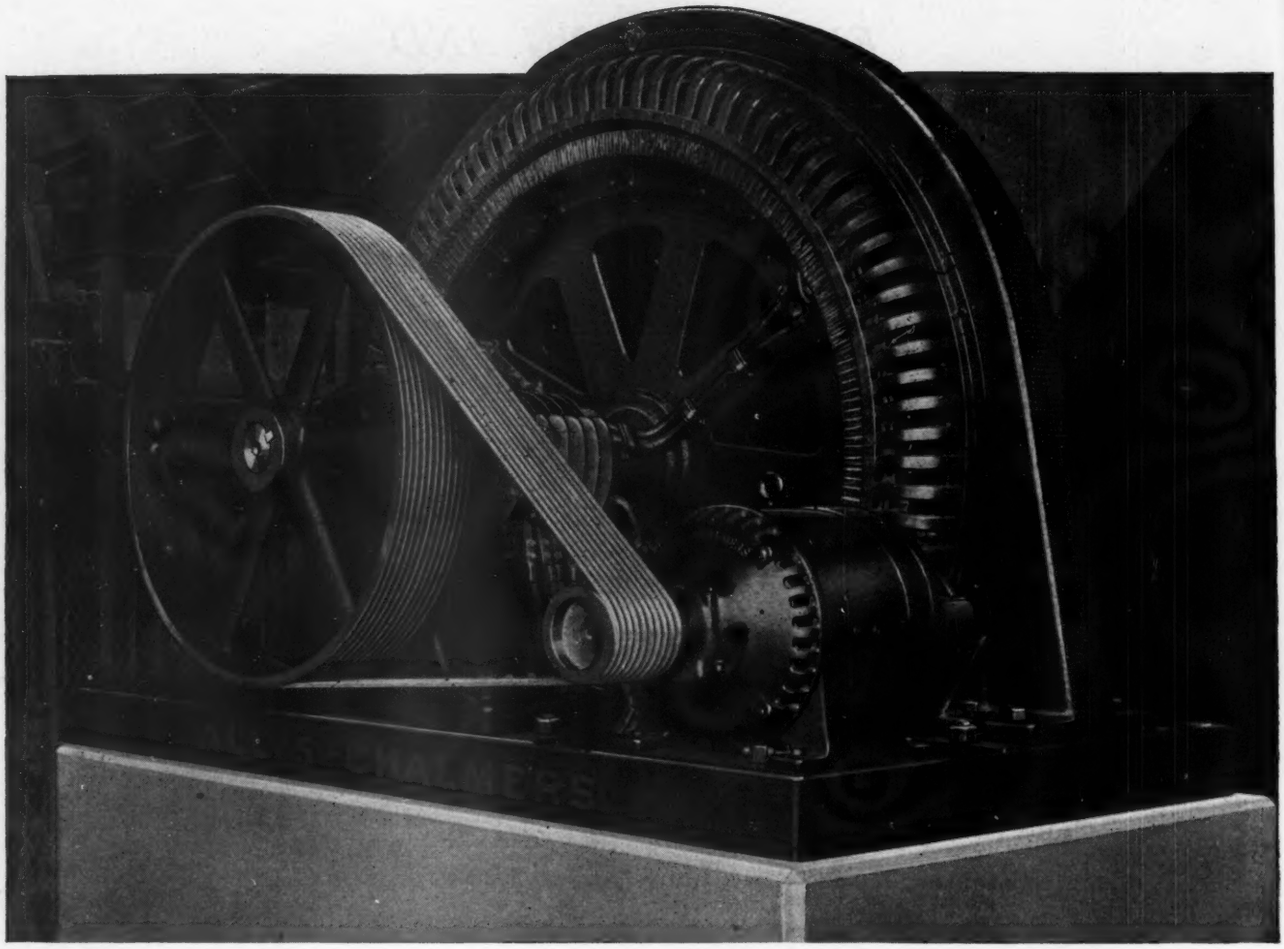

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VOLUME 128 New York, November 2, 1929 NUMBER 18

Current Trends in Aviation Vitally Concern the Mining Industry

TWO CURRENT TRENDS in aviation foreshadow developments in the near future that will vitally concern the producers of metallic minerals. The tendency toward the construction of large high-powered airplanes and the expanding use of metal to replace wood in airplane design can mean no less than that the rapidly growing aviation industry must depend for its raw materials to an increasing degree on mining. Of particular significance in this connection is the recent announcement that the air ministry of Great Britain has adopted all-metal construction of aircraft in ordering new *matériel* for the Royal Air Force. In addition to the ministry's experience that the all-metal airplane is invariably lighter in weight than its wooden prototype, metal construction has also been found to be more economical.

Progress made in the adaptation of metal alloys in airplane design received much attention at the recent convention of the American Electrochemical Society at Pittsburgh, which was attended by a large number of aëronautical engineers. At the sessions of the convention the application of the aluminum and magnesium alloys, particularly, was discussed. Speaking of these, Mr. W. G. Harvey, of the Aluminum Company of America, said that, owing to the recent discovery of methods of purifying magnesium and of methods of heat-treating, magnesium-alloy castings can now be made that possess mechanical properties equal to the best of the high-strength aluminum alloys. Furthermore, magnesium forgings having comparatively high mechanical strength are now available, and forged magnesium airplane propeller blades are being produced that do not differ materially in weight from those made of wood.

Among the all-metal airplane manufacturers in the United States, the Ford Motor Company is the largest producer. Recently, however, the General Motors Corporation announced the formation of the Dornier Corporation of America—to manufacture flying boats of the Dornier design. This design, as exemplified in the DO-X which recently took off from Lake of Constance, Germany, and flew for an hour with 169 persons aboard, is also of metal construction. In brief, therefore, two of the most important producers and competitors in the automobile industry are building up organizations to manufacture large metal airplanes. This is a healthy situation, and, although it probably does not presage a growth in the aviation industry in the next decade comparable to that fostered largely by these two companies in the automotive industry during the last ten years, it undoubtedly will be instrumental in expanding materially the demand for mineral products by the aviation industry.

Metal Industry Suffers Little From Wall Street Crash

MORE PERSONS felt the shock of the drastic decline in securities in Wall Street, which occurred late in October, than ever before in the history of the stock market. The turnover of one day alone assumed such proportions—almost twenty million shares on the two exchanges—that evidently a wave of general liquidation was let loose on a market extremely sensitive to predictions regarding industrial conditions. The pace of business had increased so fast in the first nine months of the year that some reaction was natural. Business indicators revealed that a slackening in activity had occurred in more than one direction, and speculators became nervous.

Wall Street, observers frequently point out, has a way of curing its own ills, but unfortunately the process of restoring the market to a healthy condition is not always a painless one. High-grade securities the prices of which had not been greatly inflated—and there were some—suffered along with the speculative favorites. Not until leading bankers announced publicly that the financial structure of the country was fundamentally sound was the price decline arrested.

The question is: What influence will the deflation in stock quotations have on business? That the decline in Wall Street prices will be felt by business goes without saying; the so-called luxury commodities at least will experience a temporary contraction in demand. For the basic industries, however, any reaction that may occur should be considered only a breathing spell. With the possible exception of the automotive industry, the commercial world has not forgotten the lesson learned in 1920, when huge inventories brought on what is now referred to as the post-war deflation.

The mining industry, and more particularly the non-ferrous metals division, is in position to face the future with composure. At no time in the history of the industry has more intelligence been applied to the production and marketing of metals. Some errors in judgment may have been made in carrying out the plans for placing the mining industry on a sounder economic basis, but, everything considered, the industry has made substantial progress, which should continue despite any Wall Street speculative crashes. Because of the atmosphere of uncertainty now obtaining, the non-ferrous metal market may not be characterized for some weeks as firm and active, but with fairly close regulation of production to meet actual consumptive demand, returns on funds invested in good mining properties will probably be satisfactory. With less assurance of quick speculative profits in the stock market, money may be more easily available for constructive mining development.

Sunshine Compensation for Underground Workers

THE USE of ultra-violet rays to compensate for the lack of exposure to sunshine that steady work underground entails would suggest itself to physicians responsible for the health of those who spend a large part of their active life beneath the surface. To others and probably to mine managers who are familiar with underground conditions and who realize that most miners work underground without apparent deleterious results, the innovation would not appear necessary. Nevertheless, the physician's attitude is probably well taken, and his endeavor to supply artificial sunshine by the quartz lamp may turn out to be an important step in the right direction. The first attempt to use the beneficial effects of artificial sunshine in a Western mine should therefore be a matter of interest. At the Bunker Hill property of the Bunker Hill & Sullivan Mining & Concentrating Company a solarium has been constructed in close proximity to the change house. This is equipped with six quartz lamps arranged to throw their rays toward a locus established by a traveling platform on which the patients recline. Suitable hoods and screens prevent other dispersion of the rays. The rate of travel is such as to give the whole body one minute's exposure, colored goggles being worn to protect the eyes. Miners use the solarium three times a week, and 300 men can be served per hour. The minute's exposure is sufficient to cause a pink reaction to the skin. The arrangement is such that no time is lost in handling the men coming off shift.

Such equipment has been installed in sanatoriums, hospitals, and, to some extent, in athletic clubs. Individual lamps are being used in private homes. How beneficial will be the effect when applied upon a comparatively large scale to the Bunker Hill miners will be of interest. Some time must elapse before an adequate answer can be given. However, the officials of the company are deserving of great credit for their initiative and enterprise in making an additional effort to overcome one handicap the underground worker has to face.

A Radical Suggestion— and a Silly One

OUT in the Iowa cornfields the farmer is sitting on his doorstep with a heavy heart. The politicians, lavish with promises before election, seem to have forgotten him. The tariff that was to afford him some measure of relief has degenerated into a hopeless hodge-podge, which probably cannot be passed before the present session of Congress ends. His plight is a sorry one. But he has one of those rare jewels—a friend in need. United States Senator Brookhart suffers with each one of his constituents and with all of them. He cannot bear their misery, and because he knows that misery loves company, he has made a proposal. It is the most radical one, he declares, that he has made since entering the Senate. He proposes that no corporation shall pay dividends of more than five per cent on its invested capital. Excess profits will be turned over to the government, which will return fifty per cent of the total when the company is liquidated. All other earnings will be diverted to the Treasury of the United States. This simple expedient will remove the obligation of the farmers to pay taxes.

What would happen to the mining industry were any such scheme adopted? At five per cent annually, a mine would have to have an assured life of twenty years before its capital would be returned. Under these conditions, how many investors would want to put money into American mines, when Roan Antelopes and Mount Isas are available in foreign fields?

Knowing that his proposal has not the slightest chance of being passed, Senator Brookhart has taken advantage of an opportunity to play on the feelings of the old folks at home. Iowa has few manufacturing industries or mines. Hardly any voters earn their living by working for a corporation. The Senator, therefore, runs little risk of antagonizing his constituents. He is playing politics pure and simple. If he is a Socialist, he should be honest enough to say so. If he is not, he must realize the absurdity of his proposal under a capitalist system.

Secret Processes and the Making of Vast Profits

A CORRESPONDENT sends us a prospectus issued by a concern in Denver, with request that we comment on the statements therein. We are glad to do so, for the benefit of intending subscribers to the stock of the Interstate Co-Partnership Association, as the company is named, and in the interests of the mining industry in general.

The brochure is titled "Results Accomplished," and on the cover page is reproduced a photograph of the "Denver plant"—which looks like an abandoned industrial building—in which, one is assured, has been erected a 100-ton unit for the treatment of vanadium ores, space being available for four more similar units. The Association, we read, "owns and controls the Knight electro-chemical ore process, with full rights on various devices and secret methods for treating ores for the extraction of metals. The usual organizer," the prospectus affirms, "would have capitalized this Association into the millions of dollars. In view of the fact that the profits will be so great that future expansion can be financed out of the returns of the first plant, thus requiring comparatively little initial capital, having the first unit completed and paid for, the Trustees have decided to limit the sale of stock to 10,000 shares at the uniform price of $5 per share, for additional working capital."

The Association will engage in the business of custom treatment of metal-bearing ores, the reader of the prospectus learns, being told also that "it matters not how many there are in the business; whether or not the country is excited over political agitation, or war strifes, the ore reduction plant runs steadily on, and its products have a steady cash market." Follows a recital of the success of Rockefeller, Carnegie, and others—the usual prospectus bait. Moreover, "It should be borne in mind

that in buying the stock of this Association, you are investing in the safest and most profitable of all industrial pursuits, the ore reduction business, in which the element of risk is practically eliminated. It will erect its plants only in districts where large and suitable bodies of ore are known to exist. All its work will be done on a cash basis, and its profits will be absolute and positive."

The reader, however, becomes disturbed by inconsistencies and contradictions in the statement. The Association purports to invade the custom-plant branch of the mining industry; yet the prospectus refers to the acquisition of over 1,000 acres of "choice ground" in Colorado and Utah. One is assured that "competent mining engineers" have "estimated conservatively more than fifty million tons of good ore available, which will supply us with material for treatment, at full capacity, for many years to come." How, then, the inquisitive will ask, can custom ore be treated in addition?

Specific data in the prospectus indicate that the Association purposes to concentrate its activities on the treatment of the vanadium ores of Colorado. The reader is assured that the mining and treatment expense is overestimated, and that the estimate of profit is minimized. The writer discusses the "products known to the trade" as V205 and U308—which might well refer to undersea craft. However, a conservative estimate of a recovery of ninety per cent of the "values" is given as the basis of calculation, leading to an income of $235 per ton of ore treated, from vanadium, uranium, and radium. Deducting assumed costs, a net profit of $202.30 per ton results, which, by simple arithmetic, with only the first 100-ton unit in operation, grows to $20,230 per day, $606,900 per month, or $7,280,800 per annum. Enormous dividends are assured, "which will be duplicated many times as additional units are put in operation."

One can only lament the fact that the mining industry is the victim of unrestrained promotions of this character, despite warnings to investors. Such appeals, in the aggregate, cause the deflection of vast sums of money from ventures sponsored in a manner that inspires confidence and indicates reasonable returns. The Interstate Co-Partnership Association states in the prospectus that it reserves the right to discontinue the sale of these shares at any time, without notice. *Engineering and Mining Journal* suggests that a wise course would be to discontinue the sale at once, before embarrassing questions are asked by agencies concerned with or responsible for better business methods.

Has the Machine Increased Accidents in the Mining Industry?

A CRITICISM most frequently leveled at our machine age is that the number and the horror of accidents have been increased. One need but glance at the total of deaths resulting from the misuse of the automobile to appreciate that the criticism is sometimes justified by fact. The critics forget, however, that accidents are by no means a necessary consequence of the use of machines.

The yearly study of the United States Bureau of Mines, on the number of fatal and other injuries suffered by employees in the mining industry, again shows a highly commendable reduction in accident rates. In 1926, for instance, 3.47 men were killed for every thousand employed. In 1928, this figure had been reduced to 2.50 per thousand. Similarly, other accidents have declined from 245 to 206 per thousand.

Within the same period, the number of men employed in mining has dropped from 127,823 in 1926 to 113,866 in 1928, although no decline in the total ouput of metals has occurred. Fourteen thousand fewer men are needed to produce the same amount of material! And this change has taken only two years. Mechanization and large-scale operation are responsible.

Correlate these two phenomena—fewer accidents per man employed, fewer men employed—and no more striking proof is needed of the contention that accidents are not a necessary result of the use of the machine. End carelessness, and maintain proper operating conditions whether in the mine or in the factory, and one more objection to the machine will be removed. Not that the silencing of criticism should be the prime mover in so worthy a cause. The prevention of suffering should provide a sufficient incentive.

Co-operation Between Contributor and Editor

SINGLE-SPACED manuscripts are a nuisance to editor, compositor, and proofreader. Unless the writer of a contribution leaves enough white space for instructions to the mechanical department, the manuscript, after preparation, must either be retyped and checked against the original or sent to the compositor as corrected by editor and copy reader. If a single-spaced article, as edited, be sent direct to the compositor, he is compelled to decipher it as best he can. Work is slowed down and complaints develop. Time is lost and annoyance is inevitable.

All who voluntarily assume the role of authorship will promote their own interests and facilitate the satisfactory handling of their manuscripts if they will observe a few simple rules, for which there is sound reason in the technical and routine mechanical requirements of publishing.

Engineering and Mining Journal has prepared a backing sheet for use when typewriting, containing suggestions to authors. A copy of this will be sent on request.

Cyanide Regeneration Ef

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THE REGENERATION OF CYANIDE *from waste solution offers many opportunities for the more economical utilization of the MacArthur-Forrest process. Many metallurgists have attacked the problem, and the success recorded herewith has been attained mainly because of the attention paid by the engineers of The Merrill Company to the economic as well as the technical problems involved. In the issue of "Engineering and Mining Journal" of April 21, 1928, Mr. Paul T. Bruhl described how a gross saving of $21,000 had been effected by the utilization of the Mills-Crowe process during the first year of its operation at a large property in Honduras. The accompanying abstract, from a paper by Mr. C. W. Lawr, metallurgist for the Cia. Beneficiadora de Pachuca, indicates a saving at that property of $250 per day—a significant amount. . . . To date, success in the regeneration of cyanide has been almost entirely in connection with the treatment of silver ores, where high-strength solutions are necessary. It is not too much to expect that the scope of the process will be extended as the many inherent problems are solved; and that opportunity will be demonstrated for its use, perhaps in modified form, for the recovery of cyanide in weaker lixiviants. This should open the way for the beneficiation of cupriferous gold ores, and for the more scientific treatment of other types of gold ore—by milling and thickening in alkaline water—and the avoidance of the loss of cyanide in accumulating plant solutions. . . . Mr. Lawr's original paper—Technical Publication No. 208, A.I.M.E., which was discussed at the October meeting in San Francisco—is worthy of study by all metallurgists and executives who may be interested in reducing the cost of the cyanide process.*

THE ORES MINED by the Santa Gertrudis Company, at Pachucha, Mexico, are mainly silver-bearing, yielding also some gold and carrying a little copper. Strong solutions are necessary, Aero-brand cyanide being used, and the mechanical loss of cyanide has been considerable. In 1923, the Merrill company announced its process for the recovery of cyanide from weak wash solutions, or for the transference of cyanide from a foul mill solution to a clean alkaline solution. This method, known as the Mills-Crowe process, consists of (1) acidification; (2) dispersion of the HCN from the acidified solution, and (3) the absorption of the HCN in an alkaline mill solution, supplemented by the removal of precipitated silver or copper, or both, by settlement or filtration.

Equipment was ordered in July, 1924, and at the end of March, 1925, the plant started operating on a 1,800-ton basis. The essential apparatus comprises:

1. *The Acidifier*—a tank in which the solution is treated with SO_2. The sulphur burner is a rotary machine 30 in. in diameter by 8 ft. long, made by the Glens Falls Machine Works, Glens Falls, N. Y. Four ¾-in. nozzles are arranged on the same plane near the bottom of the acidifier to impinge against a 12-in. pipe suspended from the top cone. Lime is disbursed on the sides of the acidifier. As now operated, each acidifier is independent and is cut out and cleaned after a fifteen- or twenty-day run. The solution pipes require cleaning only once in two or three months. Lime left in an acidifier after handling 85 tons of solution per hour for 24 hours is 959 lb. of $CaSO_3$ with 35 per cent moisture, but the amount varies according to the lime content of the acidifier feed and the acidity of discharge. A 6-in. concrete lining to a height of 9 ft. prevents corrosion of the metal.

2. *The Disperser*—a tall, closed tank in which the HCN is removed by air circulated through the solution from the acidifier.

3. *The Absorber*—a closed tank similar to the disperser as used at Santa Gertrudis, in which the HCN given off from the disperser is absorbed in an alkaline solution.

4. *The Clarifier*—At Santa Gertrudis the water wash effluent treated in the recovery plant contains sufficient silver to make it worth treating. If the solution discharged from the last disperser contains enough free SO_2 and has been sufficiently dispersed, the copper and silver, if present, will precipitate completely, the precipitate being subsequently removed from the acid solution. For the purpose a 35-ft. Dorr thickener was converted into a filter tank containing Butters-type leafs. This filter is known as the recovery plant clarifier.

Acidifier Exhaust Fan—This is used to draw SO_2 through the acidifiers. It is a No. 4 Sturtevant "Monogram," belt driven at 1,448 r.p.m. by a 2-hp. General Electric motor.

Disperser and Absorber Fans—These units consist of one No. 9 Sturtevant "multivane" fan driven at 830 r.p.m., 64-hp. motor, producing 19,000 to 23,000 cu.ft. of air per minute; and one No. 4½ Sirocco fan driven at 1,080 r.p.m. by a 30-hp. motor, and delivering 10,000 to 12,000 cu.ft. per minute. Each of these fans serves a unit. The No. 9 fan serves two dispersers and two absorbers. The No. 4½ fan is connected to one disperser and one absorber.

fects Substantial Savings

at a Mexican Plant

Pumps—The function and capacity of the pumps, handling 2,000 tons of solution a day, follow:

Function	Type and Capacity
1. Lift (12 ft.) from storage tank and forcing through nozzles in acidifiers.	Two 5-in. Goulds closed-runner centrifugals in series, driven by 5- and 10-hp. motors.
2. Lift (18 ft.) from bottom of disperser No. 1 to top of disperser No. 2.	One 5-in. Goulds centrifugal, driven by 5-hp. motor.
3. Lift (9 ft.) to bottom of disperser No. 3 forcing through nozzles.	One 5-in. Goulds centrifugal, driven at 1,750 r.p.m. by 10-hp. motor, developing 16 lb. per square inch at nozzles.
4. Lift (55 ft.) from treated solution sump to clarifier.	One 4-in. Goulds centrifugal, driven by 15-hp. motor.

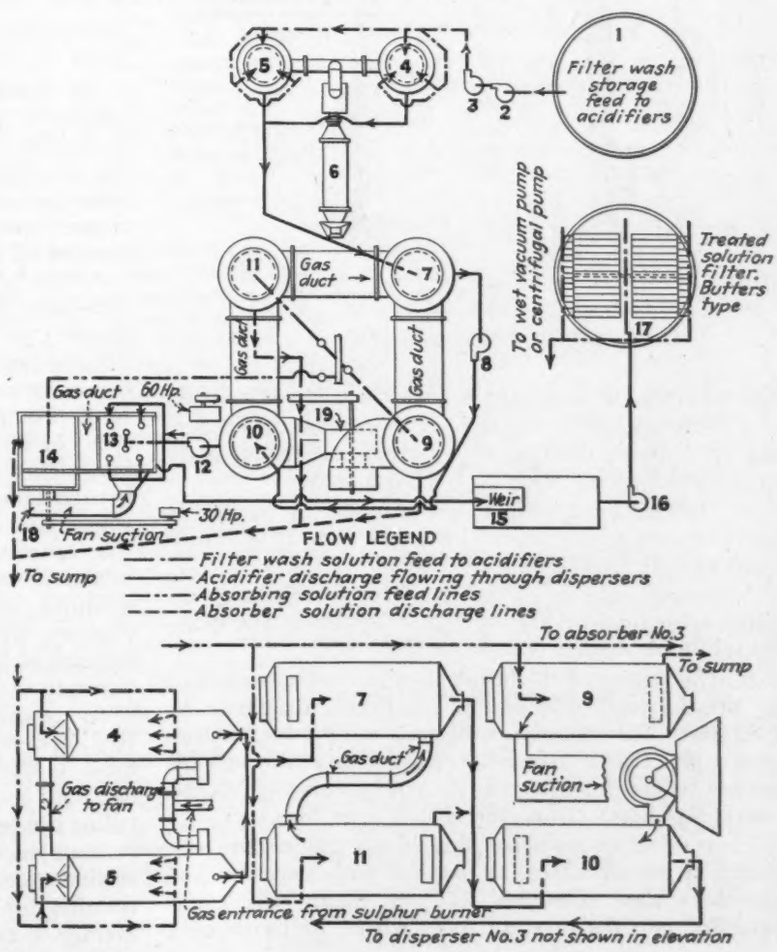
As the whole plant is working at maximum, and as Nos. 1 and 2 dispersers are operated as one unit, all jobs that would require a plant shutdown are postponed until the regular monthly stop of the cyanide plant. Continual correspondence and personal contact were maintained with the cyanide-recovery plant at Fresnillo. This was mutually beneficial, and it is suggested that when other metallurgists are operating similar plants they should keep in touch with one another. The principle of this fairly new process is relatively simple, but the final mechanism of the plant has yet to be worked out. The operation of the plant requires the services of one man per shift, spent in feeding sulphur, taking samples and weir measurements hourly, noting and recording the amount of solution in the acidifier feed storage tank half-hourly, oiling pumps and fans, and looking after the plant in general. He also titrates the final disperser discharge hourly for acidity, to keep sulphur consumption within reason. A boy is also kept on day shift to titrate the acidifier feed and all the disperser discharges hourly. He calculates the percentage dispersions and posts the results for the burner operator. Although the titrating boy is not a necessity, his hourly results keep the operator alert and are also of assistance to the night man. The latter, by looking over the day's results, can tell about what to expect in the way of recovery when running with a given acidity. The greatest item in labor cost is the necessity of removing the lime from the acidifiers twice a month and cleaning absorber grids each month. Every four to six months the grids in No. 1 disperser must be removed; those in No. 2 will probably not have to be taken out oftener than once in twelve to eighteen months. The sulphur burner and No. 9 fan are also cleaned monthly; also, the pumps are overhauled and, when necessary, are packed.

Careful control of this process and proper measuring, sampling, and rapid testing are essential. This is done hourly.

1. Solutions are analyzed for total constituents and for KCN content by the regular methods.

2. The solution discharge from the last disperser may be white, even when it is alkaline, when the flow is started through the acidifier. Lime in suspension causes this whiteness, but it can be easily distinguished from

Fig. 1—General arrangement of cyanide recovery plant



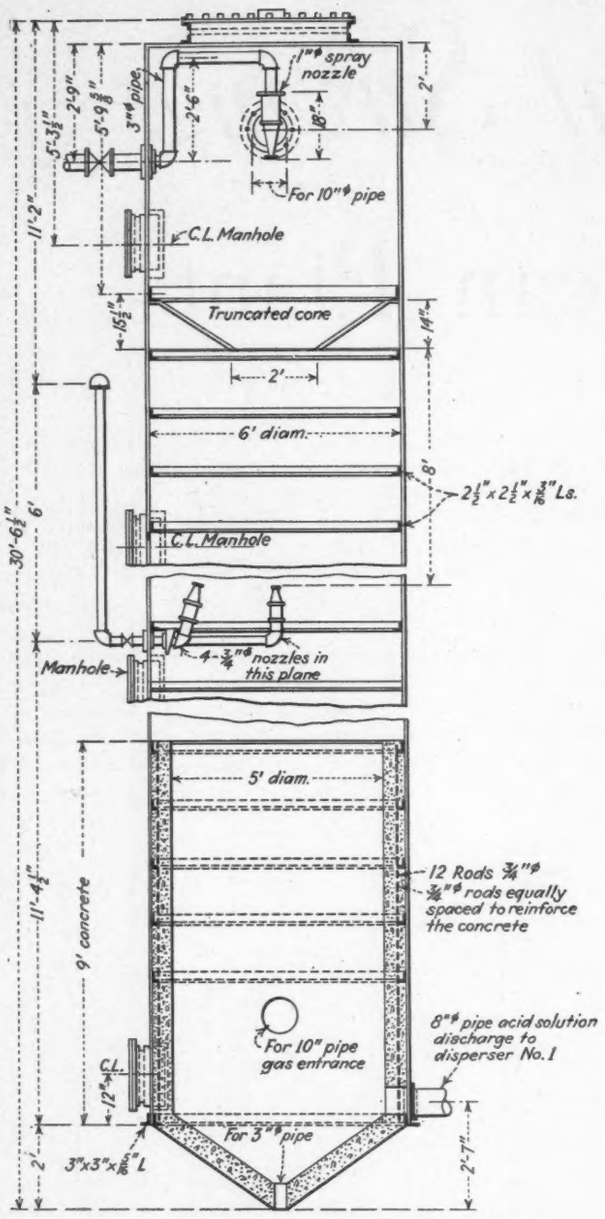


Fig. 2—Details of acidifier

the milkiness that denotes a properly acidified solution.

3. Sulphur lost is determined by passing 50 liters of the stack gases through N/10 iodine and titrating the unconsumed iodine with N/10 thiosulphate.

4. Hydrocyanic gas lost is determined by passing 50 liters of stack gas through a 1 per cent solution of NaOH contained in four absorption bottles.

5. Hourly samples of the last disperser discharge are titrated for total acidity with phenolphthalein and qualitatively with methyl orange for free SO_2.

6. The acidity of the disperser solutions is determined by titrating with NaOH, using phenolphthalein as an indicator. This represents the total acidity due to bisulphites, plus that of free SO_2. This acidity, although important, is not so much so as the acidity to methyl orange, which represents the acidity due to free SO_2 only.

7. In order to get some idea of the comparative efficiency of the absorbers, the tops of both dispersers and absorbers were connected by ½-in. piping which was extended into the titrating room where, by means of a connection with a wet vacuum pump, samples of gas could be drawn from the top of any tank desired. With this arrangement it was hoped that if gas could be drawn from the top of each tank in turn for the same period, and completely absorbed in NaOH, the amounts so absorbed could be compared, thus indicating the comparative richness of the gas circulating and the amount of absorption.

8. In making laboratory dispersion tests, to determine the effect of poor absorption on the rate of dispersion, the procedure is as follows: Two liters of the acidifier discharge was placed in a 2½-liter acid bottle. In one case gas from the top of No. 2 absorber, and in the other pure air, was drawn through for 1 hour by means of a connection to the clarifier wet vacuum pump. At the end of 5-min. intervals, 50 c.c. was removed and placed in an Erlenmeyer flask containing quicklime, and 10 c.c. additional was taken for an acidity determination with standard NaOH. The sample containing lime was well shaken, filtered, and titrated for total KCN with standard $AgNO_3$, using KI indicator. At the end of one hour, the final tailing solution was titrated for total KCN both before and after filtering off the precipitated AgCNS and CuCNS, 50 c.c. in each case being used for these determinations. The titration after filtration was much higher than before filtration. The low titration obtained on the solution before filtering off the sulphocyanates of copper and silver is due to the fact that these precipitates slowly redissolve when the solution containing them is made alkaline. On going into solution, cyanide is taken up and becomes untitratable by the Liebig method.

9. As the acidifier solution feed was low in gold, assays were made in the usual manner by evaporating 15 liters of the solution tested.

10. When treating working solution, be it filter-wash effluent or barren, the actual amount of cyanide possible to recover will, as a rule, be greater than that shown by the titration for total KCN. Where this occurs the difference is caused by the presence of silver and (or) copper tying up cyanide that becomes untitratable by the method used.

As the solution being treated at Santa Gertrudis contains both metals, there may be a considerable difference between the amount of cyanide recoverable and the quantity indicated as present by the acidifier feed titration, depending on the amounts of silver and copper in the feed. For example: the cyanide titrations (0.00062 per cent) of the disperser tailing after 80 min. dispersion is much less than that (0.0035 per cent) for the 2-hour dispersion tailing. The same amount of air and the same volumes of solutions were used in both groups of tests. The differences in the results arise from the fact that in the former all titrations but the last were made on solutions in which the copper and silver sulphocyanates were caused to redissolve by means of the addition of lime. While the titration for total KCN must be made in the presence of the redissolved copper and silver, to calculate the correct extraction on the acidifier feed, the precipitated sulpho-cyanates of these metals must be filtered off and the filtrate made alkaline before the total available cyanide remaining in the disperser tailing can be determined by the Liebig titration.

An idea of the actual amount of cyanide in the acidifier feed compared to the quantity shown by the titration for total KCN is obtained by stating that the average of twelve laboratory dispersion tests was 0.09092

per cent KCN and 0.10588 per cent respectively. By actual cyanide is meant the total cyanide available for recovery in the recovery plant. These tests were made in September, 1925, so they should show a smaller difference between actual cyanide and titratable cyanide than similar tests made a year later, due to the constant building up of the copper in the cyanide-plant circuit. In an effort to prove this assumption, tests made in July, 1926, gave 0.09810 per cent KCN in the acidifier feed and 0.1166 per cent total available KCN after absorption.

The tests for these results were made by taking 500 c.c. of the feed to the acidifier, adding a little Na_2SO_3 and KCNS, making acid with 30 to 40 c.c. of normal H_2SO_4, and dispersing for one hour. The HCN driven off was absorbed in a 1 per cent solution of KOH, of which 200 c.c. was in each of four absorption bottles.

The daily average KCN in the last disperser discharge, as indicated by the hourly titrations, was always higher than the composite sample of the same solutions for 12 hours, because the sulpho-cyanates of copper and silver in the samples tested hourly did not have time to dissolve completely upon being made alkaline with lime. This gave high titrations. On the other hand, the hourly samples taken remained in contact with lime for 12 to 24 hours before being titrated, so that the sulpho-cyanates had time to take up their full quota of cyanide, with resultant lower titrations.

To be able to report a metallurgical and financial suc-

Suggestions for Erecting and Operating a Cyanide-Recovery Plant

1 The acidifier discharge should flow by gravity into the top of the first disperser; and, preferably, through all the dispersers and to the clarifying filter, if one is used, by gravity. Only the clarifier vacuum or centrifugal pump handling the acid solution drawn through the filter leaves would then be needed.

2 To dip parts or to paint steel acidifiers, dispersers, and absorbers in hot asphalt is better than to use a non-resistant paint.

3 Acidifiers, dispersers, and absorbers should be of wood, square in section, with double walls with heavy tarred roofing paper between. These are more economical than steel or concrete units, in first cost and upkeep.

4 An economic balance between the sulphur burned and the cyanide dispersed must be determined for any given dispersion and absorption capacity.

5 Exhaust-fan connections at the acidifiers and the stack into which the fan discharges should be of wood. If the acidifiers are of wood, the SO_2 entering them should first be cooled.

6 Although elemental sulphur is the simplest source of SO_2, it is expensive. A supply of gas sufficiently rich and constant can be obtained by roasting sulphide ores or concentrate. Sulphur for the recovery plant might thus cost little or nothing.

7 Under some conditions it might pay to conduct stack gases to a simple scrubber requiring no power and easy to clean. The scrubber could discharge into the storage tank feeding the acidifiers.

8 Inasmuch as dispersion is adversely affected by low temperatures, it was found profitable to heat the solution before dispersion, as is done at the Tonopah Extension mill, where the Halvorsen process is employed. If the solution is charged with lime, however, heating may cause trouble.

9 For the best results, the last disperser discharge should always be distinctly acid to methyl orange. Each unit should consist of one disperser, one absorber, and one fan, preferably of wood and square in cross-section.

10 If a recovery plant is installed to treat barren mill solution, a filter for clarifying the spent acid solution may be unnecessary, although, under some conditions, even if silver is absent, such a filter would be necessary. Copper, when present in quantity in the solution, may be filtered out and shipped to the smelter; then the clarified acid solution may be used direct as a water wash, first made alkaline with lime and then used on the filters; or it may be wasted, if plenty of fresh water is available.

11 In treating barren plant solution to remove fouling agents such as copper and zinc; or for reducing the volume of mill solution so that a longer water wash can be given at the filters; or for the recovery of copper, silver, and gold from solutions derived from the treatment of gold-silver ores containing too much copper for ordinary cyanidation and too little to smelt profitably, the following treatment scheme might be satisfactory:

(a) If the copper minerals are oxidized, and if the copper content is too low to warrant a preliminary leach with H_2SO_4 or H_2SO_3, treat the ore with cyanide to recover the maximum amount of silver and copper. In the absence of gold, the silver could be precipitated with Na_2S, the barren solution treated in a recovery plant, and the spent acid solution filtered to remove the CuCNS, then used in whole or in part as the only filter wash, with the total wash effluent going back into the cyanide circuit.

(b) If gold is present, the pregnant solution should first be precipitated with zinc dust; the barren solution so produced treated in the recovery plant; the recovery-plant solution tailing sent to a Butters filter to remove the CuCNS, and the filtered solution run into a small agitator containing lime, then into a thickener the overflow of which would be used as the only filter wash, as when gold is absent. In both of these instances, water must be added as a filter wash, to compensate for the solution lost with the final tailing filter cake.

(c) The above scheme of treating silver-copper-gold ores by the cyanide process in combination with a recovery plant is feasible from a metallurgical standpoint, but whether or not a return will be made commensurate with the capital invested can be solved only by a study of the particular problem. For instance, if a low-grade copper-silver orebody is owned by a smelting company, not too distant from the smelter, its treatment by cyanidation, followed by the treatment of either the pregnant or the barren solution by the cyanide-recovery process, would offer the cheapest and most logical method of attack. The largest expense in the operation of the recovery plant is the item of sulphur, a waste product of the smelter. The ore might be given a preliminary treatment with SO_2, to extract as much copper as possible before contact with cyanide. This operation would also be free of cost so far as the reagent itself is concerned. Although all the cyanide combined with the copper could be saved in the recovery plant, the amount of cyanide required is proportional to the amount of copper in the feed. This would call for a large recovery plant. The use of a strong cyanide solution in the cyanide-plant circuit would also necessitate a longer filter wash, to reduce mechanical losses to a minimum.

cess is highly satisfactory. The preliminary estimate was based on treating 2,000 tons of solution per day, containing 0.103 per cent total KCN and 0.0726 per cent CaO. Equivalent prices for chemicals f.o.b. plant were $50 per ton for sulphur, $20 per ton for lime (100 per cent CaO) and 11.4c. per pound for cyanide. Power cost 12c. per horsepower-day.

Actual cost (U. S. currency) of recovering cyanide per ton of solution treated is as follows: Sulphur, 4.77c.; power, 1.36c.; labor and maintenance, 1.28c.; supplies, 0.53c.; shops, 0.38c.; total, 8.32c.

The actual recovery and cost covering a recent month were as follows, based on a saving per ton of solution of 2.04 lb. KCN at 11.4c. per lb.: Value of KCN recovered, 24.11c.; cost, 8.33c.; net profit, 15.78c. In other words, the total daily profit approximates $250.

Causes of "Rock Bursts" in Mines

A STUDY of the phenomena of "rock bursts," which have cost the lives of many miners and seriously interfered with mining operations, has been made by the U. S. Bureau of Mines. Rock bursts are associated particularly with deep mining operations, although they occur throughout a wide range of depths from 600 ft. downward. The intensity is usually in direct proportion to the depth, varying from a loosening and sloughing off to a violent rupture, giving rise to the term "explosive rock."

The Bureau of Mines investigation was especially concerned with rock bursts in the Lake Superior copper mines on Keweenaw Peninsula, Michigan. Rock bursts have occurred, however, wherever mining operations have been carried to considerable depths. The more important localities are the Kolar gold field, Mysore, India; the Witwatersrand gold mines, South Africa; the Morro Velho mine, Brazil; the tin and coal mines of Cornwall and Derbyshire, England; the Hillgrove district, New South Wales, Australia; the coal mines of Nova Scotia; the Cassidy colliery, Vancouver Island, British Columbia; and the coal mines of Utah and Washington.

More or less violent breaking of rock in mine workings has been variously designated as "flaking," "pressure bursts," "strain bursts," "bumps," "quakes," and "air blasts," which indicate opinions as to cause and effect. The term "air blast" has probably been most widely used, as a rapid movement of air often accompanies the more violent phenomena of rock failure.

The term "rock bursts" may be employed, although inadequately, to designate the whole range of phenomena of violent failure of rock, but a distinction should be made, particularly between different types—as, for instance, between the failure of pillars and of the wall rock. In other words, a rock burst may be a mere incident to the larger and more important action of ground movement that may be called quakes, although, being the only visible and apparent action, the entire cause and effect of the disturbance often are attributed to it.

The direct cause of rock bursts is rock pressure that may be static or active, and may be in the nature of strains or stresses existing in the rock mass. Static or potential pressure may be responsible for the whole range of phenomena observed, although the action is probably slow and lacking in violence but extensive. Active or dynamic pressure produces action that is violent and destructive but less extensive than the effect of static pressure; and strains and stresses produce action that is both violent and local. The static load causes pillars to fail extensively, usually by sloughing or spalling; the active load causes bumps and quakes; and strains are probably responsible for explosive rock.

A notable effect of rock pressure may be a general and continuous disintegration and reduction in size of pillars of ore and rock left for the support of the workings, resulting in the collapse of hanging wall and the closing of stopes, drifts, and shafts, or it may be sudden and violent, and, aside from seriously affecting the workings, may present a real hazard to the operation of mines.

In certain localities signs of disturbance may be observed for hours, days, and occasionally weeks before rock bursts occur. They consist of sounds, such as cracking, popping, grinding, and rending, accompanied by spitting and flaking of small fragments from the walls. A simmering sound may change to that of cracking, like the breaking of matches or the explosion of detonators, when flakes become detached and fly from the working face. Occasionally flashes of light that can be observed in the dark accompany the flaking. In other localities no sound of breaking off of fragments from the rock face can be observed, but failure takes place suddenly, masses slumping off or fragments being hurled with varying degrees of violence.

Various attempts have been made to obtain evidence of pending rock bursts under certain conditions of occurrence of orebodies and methods of working. "Telltales" or "policemen"—small pillars left to give warning of impending failure or collapse—have served a useful purpose, particularly in preventing loss of life. Such pillars are left at regular intervals throughout the workings. By their rate of failure the location and extent of pressure is indicated. "Talking" props have also been employed as danger signals and have the advantages over "telltales" of being inexpensive and readily set at any desired point.

Aside from the causes of rock bursts previously mentioned, others have been suggested, such as the cooling of igneous rocks, crystallization of minerals in fractured rock, chemical action through percolating waters, and occluded gases in coal and rock. Under various conditions certain formations may render one or more of these factors effective, but whether they are of much importance normally, although they may contribute to the general effect, is doubtful.

Rock bursts usually occur in groups or series for periods of days, weeks, or months. Usually they build up in strength or magnitude to a maximum, then diminish in intensity and fade out. In the South African gold mines, where seismographs have been installed to permit study of rock bursts, the shocks

ranged from 13,000 to 17,000 per annum, but only 10 per cent were considered heavy. They occurred with the greatest frequency in June and February. In the copper mines more than 300 have occurred in a day, but probably 10 to 20 is a more usual number. The last and probably most pronounced series of rock bursts began in November, 1927, reached the maximum in the latter part of December, and died out in June of the following year.

As a rule, considerable noise accompanies a rock burst, ranging from a grating, grinding sound to reports of a wide range of intensity, often resembling explosions of powder or having a sound like a clap of thunder. Although some sound practically always accompanies tremors felt on the surface, it is seldom loud, being a grating, rumbling noise.

Tremors have been felt 12 to 15 miles away, but 3 or 4 miles is more common. In the copper mines of Michigan shocks have been distinctly felt up to 6 and 8 miles. Furthermore, rock bursts have occurred simultaneously in mines 15 and 20 miles apart, coupled with an unstable condition in stopes in certain parts of the mines, small pieces of rock falling continuously. As a rule, shocks and tremors are more severe on the surface than underground, except locally where the outbursts occur.

Fracturing of the surface, even the formation of fairly wide cracks, often results from rock bursts and air blasts, the effect of the former being more extensive than the latter. The surface may be affected by rock bursts one-half to a mile or more from the outcrop, and the effect of air blasts is usually confined to an area 100 to 200 ft. from the outcrop.

In Bulletin 309, "Rock Bursts in the Lake Superior Copper Mines, Keweenaw Point, Mich.," by W. R. Crane, just issued by the Bureau of Mines, the causes and effects of rock bursts are discussed and detailed recommendations in regard to their prevention are given. Copies of this bulletin may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 20c.

Asbestos Has Interesting Developments

A DEVELOPMENT of unusual interest that may have far-reaching effects in the industry, writes Oliver Bowles, who has written the article on asbestos for the current issue of *The Mineral Industry,* which was published this fall by the McGraw-Hill Book Company, is the increasing use of molded brake linings on automobiles. The molded type is said to be well adapted for the internal brakes now so widely used. At least ten makes of cars use molded brake linings on some or all of their models, and 40 out of 84 models at a recent New York automobile show were equipped with them. About 800,000 cars having this new type of lining are now estimated to be in service. As brake-band linings now constitute by far the largest use for spinning fiber, asbestos textile manufacturers will view future developments with great interest.

Among new adaptations may be mentioned an asbestos plaster that will improve the acoustic properties of halls and auditoriums. English spinning mills are said to be using asbestos for the manufacture of artificial silk. Some experiments are being conducted on the use of asbestos for dress fabrics. In hat making, asbestos cloth has replaced other fabrics for severe service.

New York and Honduras Rosario Treats Increased Tonnage

NEW YORK & Honduras Rosario Mining in 1928 increased both the grade and tonnage of silver-bearing ore stamped, the company's annual report reveals. Detailed milling figures for the year and for 1927 follow:

Tonnage Crushed and Recovery

	1928	1927
Total tons milled	110,600	108,400
Silver content of ore per ton, oz.	22.323	21.690
Total silver content of ore milled, oz.	2,468,924	2,351,196
Silver recovered per ton, oz.	20.625	20.039
Total silver recovered, oz.	2,287,031	2,172,753
Silver recovery, per cent	92.390	92.390
Gold content of ore per ton, oz.	0.081	0.055
Total gold content of ore, oz.	8,959	5,918
Total gold recovered per ton, oz.	0.0768	0.0516
Total gold recovered, oz.	8,500	5,684
Gold recovery, per cent	94.810	94.510

Supplies Used

	1928	1927
Cyanide (100 per cent KCN), lb.	3.826	4.263
Zinc dust, lb.	0.755	0.985
Muriatic acid, lb.	0.0556	0.049
Lime (100 per cent), lb.	9.009	12.279
Borax, lb.	0.025	0.028
Soda, lb.	0.012	0.013
Fuel oil, gal.	0.026	0.040
Artificial pebbles, lb.	49.183	43.252
Foreign pebbles, lb.	0.747	1.832
Sulphur, lb.	2.38	3.049

Onyx Regularly Produced in Yavapai County, Ariz.

ONYX, as an article of commerce, includes several different varieties, says Mayer G. Hansen in a paper recently presented before the Yavapai County Chamber of Commerce, at Prescott, Ariz. True onyx is a variegated chalcedony, consisting of layers of different colors, white and black, white and pink, and other combinations, with layers in even planes and the banding straight. It is used for jewelry. Sardonyx is like onyx in structure, but includes layers of carnelian along with others. Onyx marble, the commonest type, includes two forms of calcareous rock; one is a hot-spring deposit, and the other a cold-water deposit, formed usually in limestone caves by the action of dripping water. The banding of onyx is caused by the deposition of successive layers of carbonate of lime, and the colored cloudings and veinings are caused by the presence of metallic oxides, especially iron.

The value of onyx varies considerably, the poorer grades selling for as little as 50c. per cubic foot, whereas the higher grades bring $50 or more.

At the town of Mayer, Ariz., is a beautiful deposit of onyx owned by the Yavapai Onyx Mining Company, which has been operated periodically for forty years. The property covers over 200 acres and has about ten operating quarries at present. Others will be opened as the onyx is exhausted from the pits now operating. The onyx is of a very good grade, much of it yielding a price of $15 to $20 per cubic foot. Total quarrying cost will average $5 per cubic foot, or possibly more, owing to the irregularity of the lenses, the dip of the deposit, and the overburden. The greatest volume of the onyx shipped has been quarried during the past eight-year period, during which time a yearly average of 1,400 tons, or about 15,000 cu.ft., was shipped to factories for fabrication. There is an appreciable tonnage of onyx at Mayer for which no market has yet been developed, as well as, roughly, 1,000,000 tons of better-grade onyx in reserve.

Electrical and Mechanical Maintenance

Work of the Electrician and Master Mechanic, and of Their Staffs, at United Verde Copper, Clarkdale, Ariz.

G. J. YOUNG

Drill steels are tempered on machines of this type

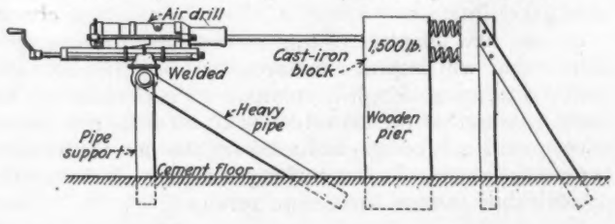
THE daily output of the United Verde copper mine is from 5,000 to 6,000 tons, from open-pit and underground operations. Underground mining extends to the 2,400 level. The mine is served by adit tunnels on the 500 and 1,000 levels, the latter being the ore outlet. Two working shafts are operated underground, No. 5 for ore hoisting, the hoist being on the 1,000 level, and No. 6 for men and materials, its hoist being on the 500 level. The surface mine plant is compactly grouped on hillside terraces close to the 500 adit. As a satisfactory plan for this plant was developed some years ago, and followed, the present arrangement of shops and details as to their equipment and operation are of interest. Furthermore, supply points and manufacturing centers are far away. Repair and maintenance work is therefore on a self-contained basis.

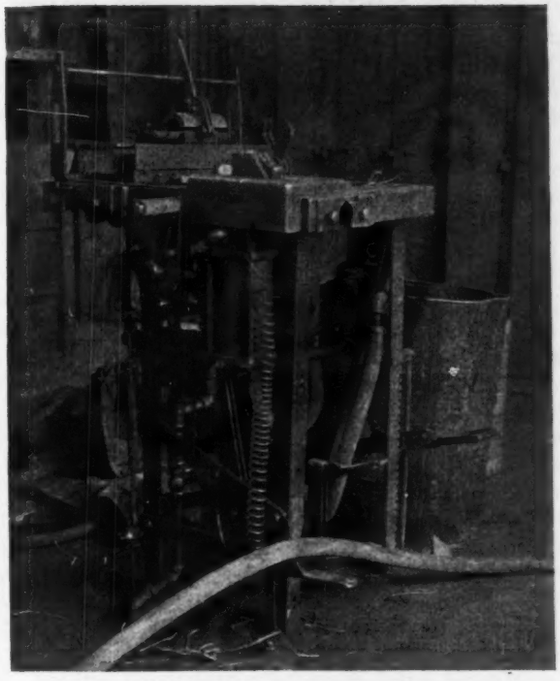
Wherever machinery is installed and operated, maintenance is necessary and repairs are inevitable. The careful selection of mechanical units in the first instance is of fundamental importance. Machinery that has been developed under service conditions should involve a minimum of maintenance and repair. New machinery is nearly always experimental, in that service is necessary to prove the adequacy of design and selection of materials. Frequently such machinery must be redesigned and reconstructed until it is able to respond to the exigencies of operation. Given a mechanical unit that has been proved, proper lubrication and operation are the factors which minimize wear, maintenance, and repair. This is understood by an experienced operating organization. Mechanical units are entrusted only to experienced operators, and are operated under conditions insuring continuous service.

At the United Verde, two broad divisions are made—electrical and mechanical—one under an electrician, E. W. Fredell, and the other under W. H. Riddle, master mechanic. Each has various foremen and shop mechanics, the work of whom is co-ordinated. Both men have attained their present positions by promotion, and therefore comply with one of the first requirements for such positions—that there be a thorough familiarity with general operating conditions and the mechanical plant. Necessarily, such men are executive workmen. They must have ability to plan and to oversee the work in detail. Their important responsibility is to keep mechanical and electrical units in efficient operation, mechanical and electrical engineers being consulted when necessary. Mine superintendents and foremen co-operate with both departments. The repair and maintenance departments are thus keyed in with engineering and operating staffs. In the personnel concerned, there is shop knowledge on the one hand and technical knowledge on the other.

Work is systematized and carried out in various shops: electrical, pipe and bolt, welding, forging and blacksmithing, plate, sheet metal, general machine, drill repair, and rope repair. If the unit is small enough, or is mobile, it is brought to the shops. If stationary, it is dismantled, and the parts are taken to the shop. Power shovels, as an example, are taken to a convenient space on the service level of the open pit, and taken apart. Each

Details of the arrangement for testing drill steels





A special hose-wiring machine is employed

repair job, therefore, involves transportation of the whole machine or parts of it to and from the shops. Groups of mechanics may be required at various places when take-down or replacement is necessary. Auto trucks are used for service between shops and open pits, and the mine transportation system is utilized between the mine and the shops.

Most of the shop buildings are of brick and steel. Many are equipped with traveling cranes, jib cranes, and the like. Drill sharpening, forging and blacksmithing, and plate work are in one building divided by brick partitions. The machine shop is in a separate building, as is also the electrical shop. Another building houses welding, pipe and bolt work, drill repairs, and several small shops. A centrally situated warehouse contains supplies, spare parts, and miscellaneous materials, except plates, pipes, ingots, and other heavy-metal supplies, which are stored in racks or otherwise outside of the buildings. All of the buildings are served by mine tracks, railroad, and road.

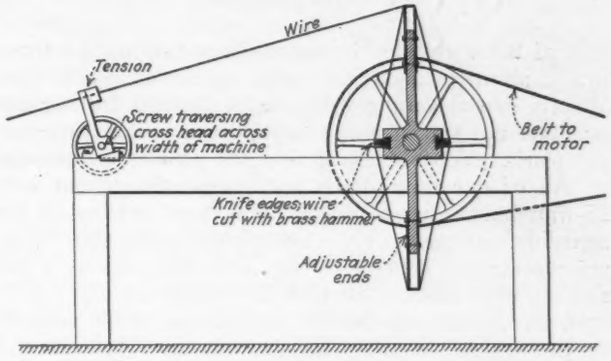
E. W. Fredell discussed the subject of electrical repairs and maintenance, and in the following I have given the gist of this interesting account. Mr. Fredell said:

"In talking about our department, it is difficult to avoid discussing other departments, as the electrical repair and maintenance men are in touch with all phases of operation. The big thing is to put rock in the box. As a consequence, a heavy producing center requires the most attention. The production department has but little time for planning, and it is therefore up to the maintenance men to meet any emergency that may arise. To adapt the maintenance organization to the needs of the day-by-day work is the important thing. The change rooms are a clearing house every morning when the electrician and master mechanic meet with the mine foremen and superintendent at the beginning of the shift. Immediate needs are discussed. Small jobs are ordered. Big jobs are approved by the superintendent, and the mine foreman and shift bosses are made aware of work proposed. Every endeavor is made to avoid red tape. New construction work is taken up with the general superintendent, Mr. De Camp.

"We are 'getting by' with 24 men on maintenance, repair, and construction. We have two men in the shop; five men on the line gang who do all line work, construction, routine maintenance, and transformer maintenance; four men on trolley and battery locomotives (40 in number); a motor inspector, who looks after oiling and inspection of about 250 motors on the surface; and seven men on general mine construction and maintenance. Underground there are three motor-generators, two main motor-operated hoists, two auxiliary hoists, three motor-operated pumps, and 25 small motors on saws and ventilating fans. Peak loads are 2,600 kw.; connected load is 6,000 to 7,000 hp.; and monthly consumption is 1,300,000 kw.-hr.

Peaks are on the day shift and minimums on the night shift. Most of the power is generated by steam supplied by waste-heat boilers at the Clarkdale smelter; excess requirements are obtained from the Apache Power Company. Power is supplied to step-down transformers at 45,000 volts; distributed underground and on the surface at 2,300 volts, and used generally in 440-volt motors. The new hoist planned for No. 5 shaft will receive current at 6,600 volts.

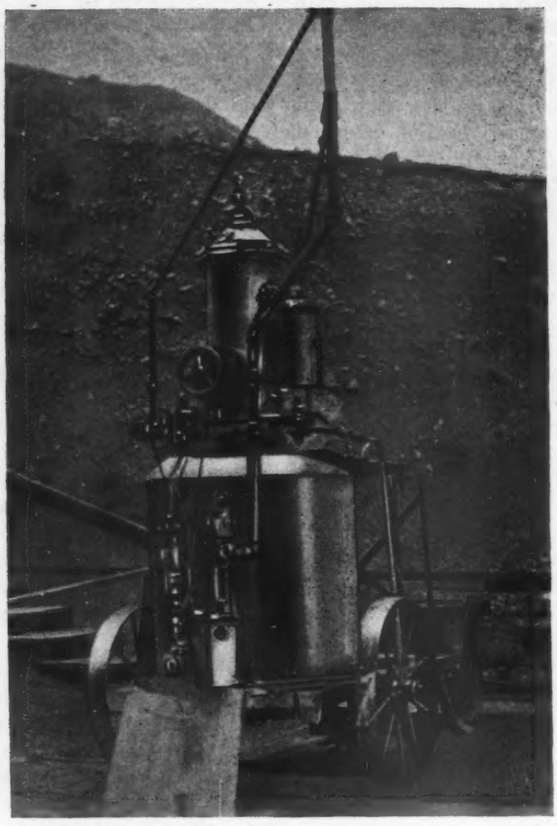
"We do not attempt to manufacture electrical parts, except in rare instances. Electrical supplies of the jobbing variety are carried in our warehouse, but we are responsible for special supplies. Although we buy coils for motors, enough magnet wire is stocked to cope with most emergencies. Our reserve motor equipment is sufficient to meet all demands, and only the failure of



Hose wires are prepared on a special machine, details of which are shown here

our hoisting equipment would be serious. Failure of our compressors is provided for by connections with the United Verde Extension's air mains. Our stock of winding material and small supplies is about $35,000. Miscellaneous parts that are stocked range in value from $18,000 to $20,000. A good jobbing service enables us to keep our supplies at a minimum and to secure a stock turnover four or five times a year.

"We buy wire once a year in carload lots and carry a $35,000 stock. Our usual order for code wires is 500,000 ft. of No. 14; 100,000 ft. No. 10, and 300,000 to 350,000 ft. No. 10. Nothing smaller than No. 10 is used underground on permanent circuits. We use 35,000 to 40,000 ft. of No. 2. Wire is the principal need in replacements. All of our No. 14 is used on blasting circuits, both underground and in open pit. Special care is taken with blasting circuits. Some reclamation is possible, and, after salvaging and inspec-



Cutting and welding is facilitated by portable acetylene generators

tion of the wire, part is returned for use again. Practically all drift and raise work is electrically blasted. We are experimenting with electric blasting for stoping, but have not yet reached a definite conclusion. In open-pit work, electric blasting is used almost exclusively.

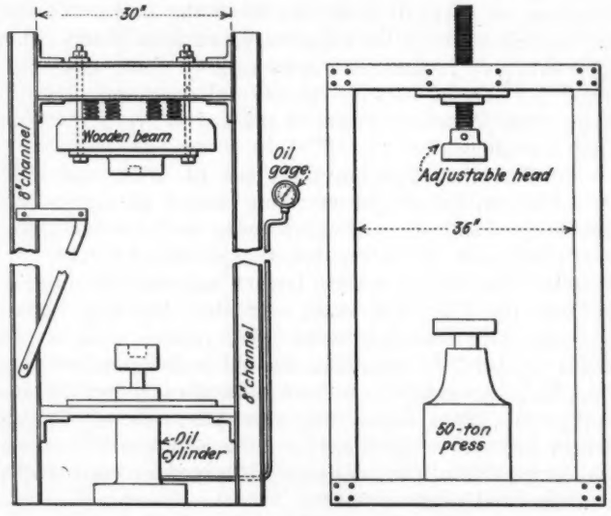
"All of our mine drifts are lighted throughout with 25-watt lamps, not so much for general lighting as for signaling purposes. Three times during the shift lights are flashed for blasting. They are also used as a fire signal (nine flashes followed by station signal). As a rule, we can get all men to the stations in ten minutes by the use of the flash signal. On the Hopewell adit a block signal system is used, as there is no foot traffic. On main production levels we use light signals. A system of signals is used on main transfer raises when blasting is in progress in the pits. These signals warn men below who may be at the grizzlies. Both lights and whistles are used. All signals are tested regularly at the beginning of the shift. On the lower levels another signal system, utilizing lights and electric horn, is in use where bad gas conditions prevail and in all sulphide stopes. These are likewise tested at the beginning of the shift. An annunciator type of signal is used at the main shafts.

"Floodlights—24-in. Crouse-Hinds projectors—are used in the open pit. They have an intensity of about 8 foot-candles, which is sufficient for good working conditions. We are experimenting with floodlighting in the stopes, and use it where scraper-loader equipment is in operation and in all large cut-and-fill stopes. Twelve-inch projectors are used underground. These are inclosed in a steel box with sliding door, permitting the lights to be left on in the stope during blasting. If the light is left turned on, it is apparently not affected by the concussion. We are getting normal life out of lamps, averaging better than 1,000 hours. In some shrinkage stopes we are using floodlights after they are drawn. In the open pit, floodlights are placed upon portable wooden stands and are protected by heavy boxing.

"Western Electric standard mine phones are used throughout the mine, and the Bell system is connected to every mine level. A telephone man makes regular inspections and maintains all equipment and lines up to the junction with the telephone company.

"Trolley locomotives are completely overhauled once every 18 to 24 months, and battery locomotives every 36 to 42 months, independent of the battery. The locomotives are brought to the shop for overhauling. Owing to ordinary maintenance work, a locomotive seldom fails to function. A complete rewind on a locomotive armature is seldom necessary, even though our trolley locomotives have been fifteen years or more in operation. Recently, most of the work done on a locomotive involved the replacement of seven coils in an armature. We have not had a complete rewind in six years. On our main haulage locomotives we replace hanger bolts every two years. No trouble is experienced with axles.

"We are installing inclosed fuses and starting equipment, and changing panels to all inclosed locked boxes, so as to avoid interference by unauthorized persons. We are still using some refillable fuses, but are eliminating as many of them as possible by substituting thermal



Right—Sketch of device employed for testing stoper drills
Left—Sketch of the hydraulic shop press for pressing out chuck bushings

relays throughout the entire plant. Although the initial installation is more expensive, the over-all efficiency is greater. We are avoiding over-fusing and have gone to 'across-the-line' starters of the push-button full-magnetic type, as the nearest approach to foolproof equipment. Time limits and relays are inclosed and are protected from interference. By fully inclosing starting equipment, the inspector is called when anything goes wrong and the equipment is fully protected.

"Except for automobile trucks, the open pit is completely electrified. On the power shovels trouble has been experienced with boom and swing motors, but this has been eliminated in the operation of the swing motors. Boom motors still require attention, and operators appear to be the main cause. Here maintenance is reduced by keeping after the shovel operators. In the

open pit the equipment is frequently moved; this necessitates changes in junction boxes. Main power cables consist of lead-covered steel-armored cable of the submarine type. Rubber-covered cable is used for trailer purposes. Trailer cables are 400 ft. long and are subjected to severe service.

"At the Hopewell adit a completely automatic motor-generator set, operated from a time clock, supplies current for the trolley haulage. This is also included in the inspection and maintenance service.

"Underground, our greatest problem is the fire hazard," continued Mr. Fredell. "Direct-current circuits in the presence of much combustible material bring about this condition. The direct-current trolley wire, transmitting 250 volts, is the most serious element of risk. Fire hazard from alternating currents is not important. We are systematically eliminating trolley wire and installing battery locomotives. Under our average conditions the life of an Edison battery is 7½ years, provided it is given proper maintenance. Later types of lead batteries have given to date 32 months' service without noticeable deterioration. The convenience of the battery locomotive and its long life make it practicable to replace most of the trolley service."

From Mr. Fredell's discussion it is evident that the most important factors in maintenance of electrical equipment are periodical inspection, the instruction of operators in the proper use of equipment, and the installation of foolproof control apparatus that will prevent interference. An enthusiastic and interested electrical superintendent is vital.

Mechanical Maintenance

W. H. Riddle has been ten years on the job. He was first with the United Verde Extension, and then entered the employ of United Verde as a blacksmith, became blacksmith foreman, and then master mechanic. His domain is a large one, as it involves practically all of the mechanical equipment. His function is similar to that of the "general practitioner"—diagnoses, surgery, and healing, as well as preventive work. His patients include 24 trucks—Morelands, Linns, and Dodges—from 10- to 1-ton, many being on the severe service of open-pit mining; four electrically operated shovels; four electrically operated churn drills; seven steam locomotives; 75 Anaconda compressed-air hoists; three geared air-driven and two electrically driven underground hoists; two main shaft hoists and auxiliaries; pumps; fans; mine cars; 40 mine locomotives; and all of the miscellaneous mechanical equipment necessary at a large plant that operates on a self-contained basis even though deriving its supplies from numerous industrial sources. Respecting the details of his job, Mr. Riddle said:

"We employ 200 men in the mechanical department. Each shop is under a foreman and operates on the day shift. When emergency work arises, other shifts are utilized until the particular job is finished. Our force includes the yard gang, compressor engineers, heating-plant men, and warehouse employees. Our most recent large overhaul job was a Mallet locomotive, the work costing $25,000. Our locomotive work includes firebox rehabilitation, turning and resetting tires, and rebuilding when necessary. On auto truck work we rebuild frames, car bodies, and engines, besides doing all of the tire and tractor tread work. We make all of the mechanical repairs on electric mine locomotives and do all of the mechanical work required on other electrical equipment.

"We have redesigned the Anaconda compressed-air service hoist, and are building new machines to these designs. Our foundry work is done at the Clarkdale smelter. On the large mine hoists we reline brakes. Other repairs on this equipment are rarely necessary, and in the past several years only a main bearing has been burned out and a clutch part renewed. Our principal difficulty with the larger mechanical units is lubrication. We have cut down the number and grade of lubricants and have resorted to the use of greases whereever possible. We have had few pump repairs, and have never had to rebuild a pump. On our main ventilating fans we have no bearing trouble. Our principal work has been in the maintenance of transportation equipment and open-pit mining units, all of which are subject to heavy wear and severe service conditions. Our men make inspections of all mechanical equipment, and our underground mechanics are required to make regular inspections."

Servicing storage batteries in the electrical shop

Shop Equipment

Mine machine shop equipment is usually restricted to general rather than special machine tools. At this shop the principal units are a vertical slotter, two radial drills, two drill presses, a 17-in. LeBlond heavy-duty lathe, a 26-in. x 12-ft. lathe, a 36-in. x 16-ft. lathe, a 42x42-in. x 12-ft. planer, and a 36-in. Lodge and Shipley lathe, as well as several smaller lathes, shapers, a boring mill, and the usual small tools, such as power hacksaws and abrasive wheels. Special equipment consists of a locomotive wheel lathe, tire press, horizontal hydraulic press for wheel and tire work, three pairs of stationary 50-ton railroad jacks, and an overhead traveling crane. Tools are motor driven. A toolroom is maintained, equipped with shaper, a heavy-duty No. 3 LeBlond milling machine, a drill press, an emery wheel, and a grinder, as well as a great variety of tools and drills. A "tin shop" for light metal work is on an upper floor of this shop.

The forge shop is equipped with three steam hammers, a heating furnace, and several blacksmith fires. Forge work up to 14-in. billets is undertaken. The plate shop is equipped with a cold saw, rolls for bending, and punch and shear machines. The pipe and bolt shop is equipped with an Acme bolt machine for threading stock up to 2 in. and three power pipe threaders for ¼ to 2 in., 1½ to 6 in., and 3½ to 12 in. pipe. Hand dies are available for outside work. In the welding shop a 30-kw. motor-generator and panel supplies current for bench

and yard work. Several portable acetylene outfits are used for cutting and welding. An Ox-weld acetylene generating set is installed outdoors near the plate shop. As in other mine shops, a great deal of work is handled with welding apparatus, which has greatly simplified cutting and construction where plates and angles are required. A feature of the work in progress was a number of steel door frames and doors designed especially for underground use.

The electrical shop is equipped with several commutator stands, emery wheels, a coil machine, an overhead hand crane, chain blocks, and charging panels for battery work. A small shop is used for all diamond-drill work. Two men are employed at setting bits. A flat rope is used for the cage counterbalance, and a small shop is provided for making it. This is equipped with lacing bench and compressed-air operated rope reel. Hoisting ropes are stored at this point, and all rope work is handled in the special shop by an experienced rope man and assistant.

Special Tools Developed for Drill Shop Work

Of special interest is the drill-repair shop. A. L. Gallardo, who is foreman, has been with the company for fourteen years. Practically all of the equipment has been designed and made in the shops. Mr. Gallardo and his assistants have shown a good deal of enterprise in developing special tools for the work. All machine drill parts are kept on steel shelving. Most of the drill repair work is bench work; drills are dismantled and worn parts replaced. Drifters are tested out at the bench, but stopers are placed in a special testing machine that indicates the feed pressure when the drill is running. For pressing out chuck bushings a 50-ton vertical press is used. This was made by building a car-wheel press into a vertical steel frame with an adjustable head block. Three small machines are in use for making steel water tubes out of cold-rolled tubing. A special drilling machine is used for drilling water tubes. A press is used for making brass insert screens. In addition, a special testing block and drill stand are used for testing drill steel. A complete record is kept of all drill repairs. Each drill is numbered and its repair history is given in detail in the record.

Drill Hose Serviced for Fire Fighting

Hose work is concentrated in one corner of the drill shop. Two machines are used, one, the McKee machine, being used for cutting, wiring, and testing hose. The other is used for preparing the hose wires: No. 14 for ½-in. hose, No. 12 for 1-in. hose, and No. 9 wire for 2-in. hose. In the mine, ½ and 1-in. hose are used and in the open pits 3 and 4-in. hose with manifolds. A number is stamped on the inside seat of the hose coupling, and a record is kept of each hose. Standard brass fire-hose nozzles, ⅜-in. in outlet, have been adopted for use with all air hose for fire purposes. By this expedient all drill hose underground can be used for fire-fighting purposes. A standard coupling is used for both air and fire hose. A good deal of work has also been done on simplifying hose and air-drill fittings.

Hammers, Stillson wrenches, and axes are repaired and serviced in this department, as well as drill columns. One man's time is taken up with servicing small tools; two men are on drill repairs; one man is employed on sharpening axes and repairing Stillsons; one man on hose; and one man on cap and fuse work in a separate building. A nipper is employed in handling drill steel on the surface and between the drill-sharpening shop and the mine.

One of the additional services of this department is the control it exercises over the padlocks and the keys used in and about the mine plant and underground. This is a minor but an important detail. Locks and keys are numbered and a record is maintained. A key machine is available for cutting keys. Surprising as the fact may seem, some 1,600 locks were used in the mine up to a few years ago, and a new series, started since then, exceeds 800 in number. Mr. Gallardo stated that the life of a padlock is not very long, being only three months in shaft service, where the locks are used to lock chute boxes and valves. All magazine doors are locked. Locks are an insurance against tampering and unauthorized interference. A master key system is in use, which would seem to be a necessity.

Maintenance and repair are a necessary feature of mine operation. Each situation admits of a plan that will entail reasonable shop equipment, such that a minimum number of men will be necessary for repair work. Without maintenance and inspection, shop repairs are enhanced, whereas, with it, shop repairs are reduced. The vigilance of these maintenance men is, therefore, an important factor. A temptation to utilize shop facilities for manufacturing prevails, and this arises from the necessity of keeping skilled shop mechanics employed. To lay off such men is impracticable, for they are frequently hard to replace. Some manufacturing can, therefore, not be avoided, but an extension of manufacturing over and above this limit disturbs the function of the repair division and is economically unsound. The United Verde shop management has avoided encroachment on the manufacturing field to a considerable extent, but, its situation being isolated, a thorough development of shop facilities has been important.

Bonus System Increases Earnings

One of the most interesting phases of the repair and shop work is the fact that for the last three years 75 per cent of the men employed in the shops, whether on new construction or repair and maintenance, have worked under a bonus system that permits earnings appreciably in excess of the base rate. These earnings depend upon the ability of the individual. Two bonus or contract engineers administer the routine of the bonus system and establish standards for all classes of work; this is done with the assistance of the foremen. Standards are based on unit operations. As an example, standardization of a job requiring a certain amount of welding or burning, some punching or shearing, combined with riveting and laying out, is based on each of the unit operations indicated, and from such unit standards a bonus for the entire job is determined. Determination of a bonus schedule on complete repairs of a Mallet locomotive at a cost of about $25,000 would appear to be difficult, but so frequently have the operations involved been performed, and so thoroughly has the segregation into smaller units been made, that the bonus department satisfactorily handles a complicated problem of this nature. The standards established, however, do not remain constant over a long period of time; as improvement is made in both facilities and methods, standards are raised accordingly. General efficiency is materially increased under this procedure, because each operator is inclined to improve the method of doing a specific piece of work so as to increase his bonus rates. The bonus system is applied both at the Jerome and Clarkdale shops.

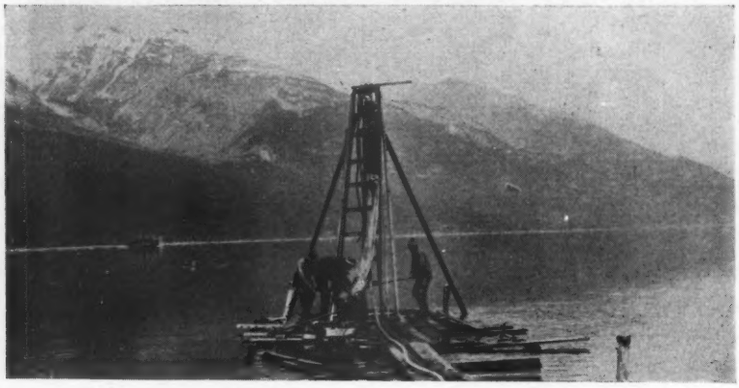
Of the Race of Titans

BEFORE electricity was applied to mechanical shovels they were limited in size by the fact that each unit must be burdened by its own power production equipment. But electricity has removed that restriction, and now energy-utilization machinery is all that need be carried. The only limit on shovel size is the boundary of imagination and the engineering audacity of designers. Here is a rather breath-taking example, digging out coal in the strip mines of Kansas. It is a Bucyrus-Erie type 750-B with a 16-yd. bucket. This is stated to be the largest strip-mine shovel in the world, and from the way the Buick coupe nestles into its maw one is inclined to accept the statement.—*Electrical World.*

USEFUL OPERATING IDEAS

Novel Method Used to Sample Tailing Under Water

HEREWITH is reproduced a snapshot of an outfit which was recently found very satisfactory in sampling a tailing dump on the shore of Slocan Lake, writes R. A. Grimes, manager for the Western Exploration Company, Silverton, B. C. The tailing was partly above water line, but most of it was under water to a depth of about 40 to 50 ft.



A water-lift sampler on Slocan Lake, British Columbia

The outfit is cheap and easily put together. It consists of 100-ft. of 3-in. standard pipe, cut into 10-ft. lengths to facilitate handling. A tee with a short length of pipe was put on next to the top length, to take care of return water and tailing. Inside the 3-in. line is introduced a 1-in. water line, which in turn is connected to the local water service. A flexible coupling was made from a length of fire hose. When the water is turned on we have an excellent water lift. Our local pressure is about 80 lb., but this could be obtained by using a pump, and would probably work at much lower pressure. The snapshot represents the practice used when working from a raft 40 ft. above the tailing to be sampled.

The man on top is standing on the tee connection, punching hard strata with the 1-in. water line. Two men at the sides are working the 3-in. line down with pipe tongs. The man in the center is taking care of the sample, which is delivered to the tank by a canvas pipe. Our longest cut in the tailing was 48 ft., with no difficulty encountered except in the recovery of the 3-in. line.

Inducing a Belt Conveyor to Run Straight

THE belt of a belt conveyor sometimes exhibits a tendency to run off center. A remedy is simple, costs almost nothing, and is applicable to any kind of troughing idler, according to R. C. P. Phillips, assistant manager for the Beni Felkai Mining Company, Les Falaises, Algeria. It consists in driving steel wedges under the bracket of the troughing idlers, so as to make the set of idlers lean slightly forward in the direction of travel of the belt. Every set of idlers need not be treated thus, unless the trouble is serious. For a normal variation, about every third set suffices.

The amount of tilt given to the bracket is about 7 deg. from the vertical, as shown in the accompanying sketch. This is sufficient except under bad conditions, where it may be increased to 10 deg. Up to this point, no appreciable increased wear on the belt occurs.

Reference to the plan of the set of idlers in the tilted position will make apparent the reason for the self-aligning action. Although the central horizontal idlers remain in the same line as before, the troughing idlers, by reason of their inclination, are now both looking slightly inward, and in consequence both tend continually to make the belt run inward, with the result that it keeps in the center.

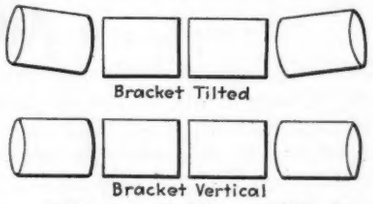


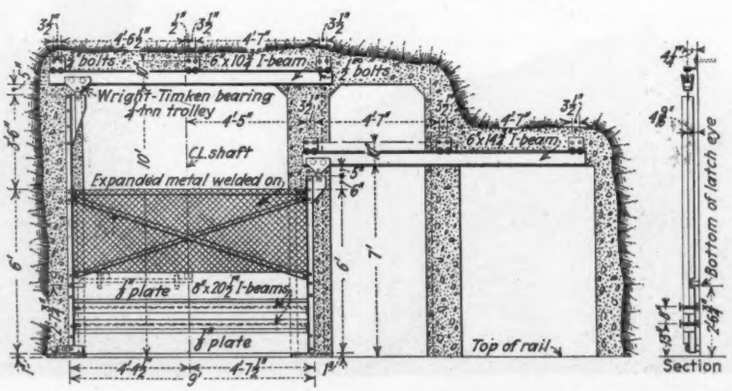
Diagram of idler modification

Provision must be made to allow the front edge of the bracket to drop as the

Station Safety Gate Proves Efficient

A SLIDING SAFETY GATE for use at shaft stations on No. 6 shaft of the United Verde mine, Jerome, Ariz., is of interest because of its steel construction and the fact that it has been made standard equipment for shaft stations at which men and materials are handled. It was designed by F. M. Kruse, chief mechanical engineer at the mine. The gate is suspended by ½-ton Wright-Timken bearing trolleys and is provided with a latch and stop clip. The upper portion is constructed of expanded metal. On the lower part two 8-in., 20½-lb. I-beams are built into the door to guard against the impact of cars. The trolleys are carried by 6-in., 14¾-lb. I-beams bolted to angles fastened to the concrete of the shaft as shown in the accompanying illustration.

Safety gate for shaft stations at United Verde Mine



back edge is raised by the wedge, so that the horizontal idlers still remain at the original height. To make the reasoning more apparent, the angle of tilt in the drawing is purposely exaggerated, as the greater the tilt the more do the troughing idlers look inward.

New Sheave Designed for Heavy Duty

HEAVY hoisting duty on the rope sheaves at one of the shafts of the United Verde Copper Company, Jerome, Ariz., has necessitated replacement of the old rod-spoke sheaves. The new sheaves were designed by H. V. Kruse, chief mechanical engineer, and were made by the Allis-Chalmers Manufacturing Company. They are designed for a rope pull of 56,000 lb., a resultant load on the sheave of 100,000 lb. and an arc of rope contact of 132 deg.

The rope diameter of the sheave is 11 ft. and the outside diameter, 11 ft. 7 in. Hubs are of cast iron, 19 in. long and 30 in. in diameter, with wrought-iron shrink rings 2x6 in. in section on each end. The keyway is ¾x2 in. The rim of the sheave is of cast steel with cast-steel replaceable blocks to form the rope seat. For these liners a Brinell hardness of about 125 is specified. Rope diameter is 1⅞ in., and the liner seat is of somewhat greater radius than the rope radius. Connection between hub and rim is made by ⅜-in. steel plates, which are attached to the rim by ¾-in. rivets spaced 4½ in. center to center and to the hub by 1-in. turned bolts with recessed nuts in reamed holes 3 in. center to center. Reinforced handholes 5 in. in diameter are cut in the plates and ¾-in. staybolts stiffen the plates.

For assembly purposes, and to provide for clearance width in the mine, the sheave is made in halves, which are joined together by plates and ¾-in. turned bolts as shown in Fig. 1. The sheave weight is 10,000 lb. In assembly the shrink rings are electrically heated.

The maximum diameter of the shaft is 12 in. This is reduced to 10 in. outside of the hubs and to 7.874 in. in the bearings. S.K.F. roller bearings designed to take care of end thrust are used. The pillar blocks are supported on adjustable wedges and these in turn are carried on a sole plate supported by plate girders as shown in Fig. 2. Sheaves of the same type are to be installed at No. 6 shaft, which is used to handle men and materials.

Graphite for Hot Bearings

THE value of deflocculated graphite as emergency lubricant for hot bearings is not fully appreciated, writes M. C. Langfelder in *Power*. A little graphite fed to the bearing so that the rotating shaft draws it in will frequently enable a hot bearing to cool down sufficiently to remain in service until attention may be given to it. About one-half of 1 per cent by bulk of graphite will usually be found sufficient.

Why Waste Condenser Circulating Water?

MOST industrial plants that generate their own power take advantage of the economy to be obtained by using exhaust steam for building heating. Frequently, however, the power load requires that more steam pass through the prime mover than can be used in the heating system, and this excess steam is lost to the atmosphere.

Under this condition, and where circulating water is available, a considerable saving can be made by condensing operation with back pressures of about eight pounds absolute, and using the hot circulating water in the heating system. With this arrangement the prime mover could satisfy the same load demand with approximately 10 per cent less steam. During the summer, when hot water is not required for heating, the same unit and condenser could be operated at as low a back pressure as the temperature of the available circulating water would permit.

In addition to the gain in economy, an added advantage is the decreased raw feed to the boilers and consequent decreased feed-water treatment.

The use of hot condenser circulating water, of course, need not be confined to building heating. It has been applied to industrial processes requiring hot water for washings and for other purposes. Where hot water for process and building heating can be utilized in combination, year-round operation with hot circulating water and low condenser vacuum may be found to be a profitable procedure.—*Power.*

Correct Priming Essential for Good Blasting

SINCE the direction in which an explosive charge builds up its maximum pressure depends so largely on the position of the detonator in the charge, preparation of the priming cartridge is of vital importance, says a recent "Explosive Service Bulletin" of the du Pont company.

As a detonator exerts its greatest force straight away from its charged end, the first principle of priming is that the long axis of the detonator should be as nearly parallel with the long axis of the cartridge as possible.

Fig. 1 shows a cartridge primed with cap and fuse by a widely used method known as "lacing." This method of priming is considered undesirable practice by explosives authorities for several reasons:

(a) If the fuse side spits into the

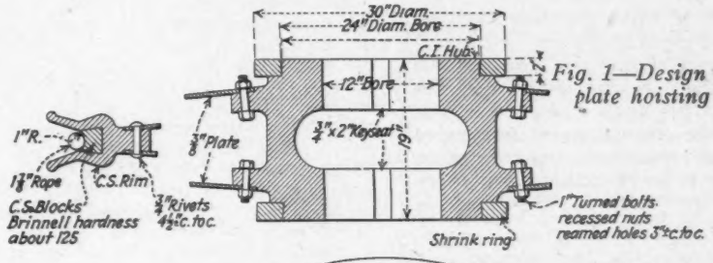


Fig. 1—Design of metal-plate hoisting sheave

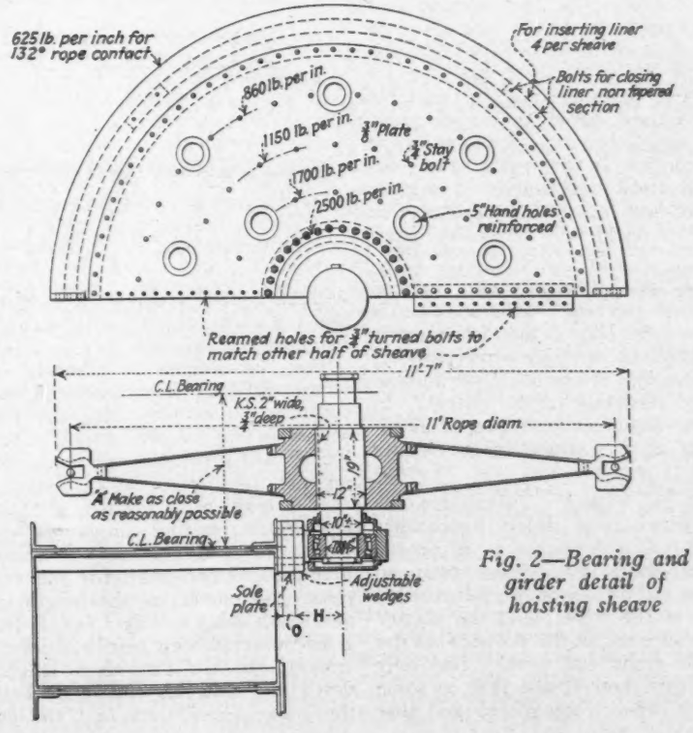


Fig. 2—Bearing and girder detail of hoisting sheave

explosive it may cause the explosive to burn.

(b) Nearly all fuse has a tar covering around the powder train to protect it from moisture. In cold weather this tar becomes brittle and breaks when fuse is sharply kinked. The breaking of this tar may separate the powder grains and cause either a misfire or a hangfire.

(c) Many miners do not realize that a detonator is so constructed that all the energy in it is compressed into about ½ in. of the closed end of the shell or that the detonator acts with greater force in one direction than in another, but think they should get it into the cartridge as far as possible. Consequently, the business end of the detonator frequently bears against the paper wall of the cartridge, and if the hole for the detonator is punched with a blunt tool the cartridge paper is often split so that the business end is actually exposed to view.

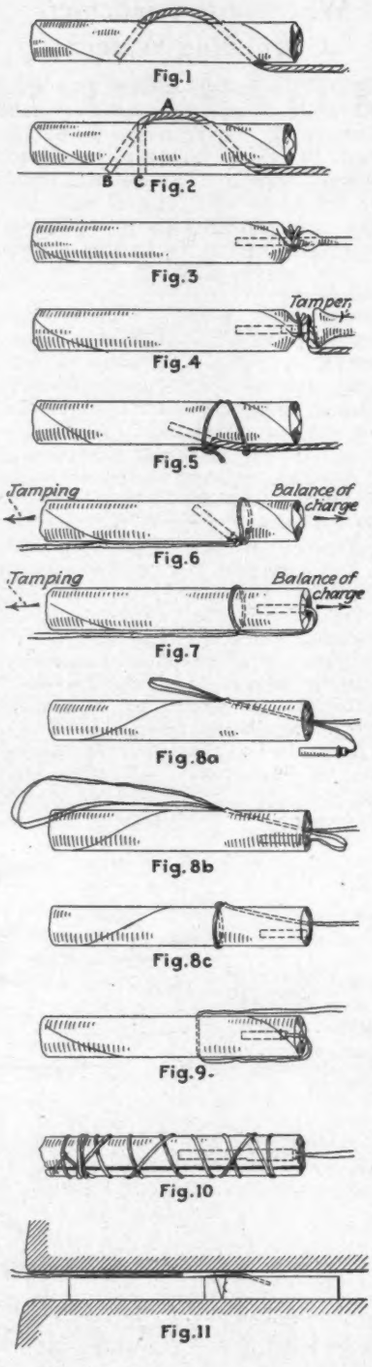
(d) When a cartridge primed in this manner is forced into a tight bore hole, as in Fig. 2, pressure against the fuse at point *A* forces the business end of the detonator, *B*, to rub against the rough wall of the bore hole, so that even if a premature explosion does not occur, the detonator is pushed into position *C*. There it shoots with greatest force into the wall of the bore hole, and the result may be unexploded or burning powder.

Fig. 3 shows a method quite commonly used in making primers for wet holes. The paper at the end of the cartridge is tied around the fuse and the joint is soaped or greased to keep out moisture. This method is good in that it places the detonator in the proper position, but great care must be taken in tamping to avoid making two sharp bends in the fuse, as illustrated in Fig. 4.

Fig. 5 shows the best method. It avoids sharp bends in the fuse and contact of fuse with naked powder. It leaves the end of the cartridge free for the tamping bar to rest against and the fuse is securely bound to the cartridge so that the detonator cannot be pulled out of place. In obtaining these advantages axial alignment is slightly sacrificed, but not to an extent that could be considered seriously detrimental.

Figs. 6 and 7 illustrate two common methods of priming with an electric detonator. In Fig. 6 the detonator is very much out of alignment, pointing toward the wall of the bore hole instead of toward the body of the charge. In Fig. 7 the detonator is in proper alignment, but again pointed in the wrong direction.

Fig. 8, *a*, *b* and *c*, illustrates the method which most nearly approaches the ideal. The detonator is in proper alignment; there is no direct strain on the wires or the detonator; there are no kinks in the wires; and the blaster is almost sure to put the primer into the bore hole right end first. The only flaws in this method are that to some blasters it seems complicated and that



with cartridges under 1⅛ in. in diameter there is a tendency to split the cartridge in punching the hole.

For small-diameter cartridges and where difficulty is experienced in getting the miners to adopt the method shown in Fig. 8, the method shown in Fig. 9 will give about the same results without damage to the cartridge.

In priming with the new type of delay electric blasting cap, there is ordinarily no reason to deviate from the practices recommended for the regular electric detonator, as the length of the new sixth delay is only 4 in. If trouble is encountered with small-diameter cartridges, slit the cartridges lengthwise down one side, lay the delay between the halves, and then fold the halves tightly together the full length of the cartridge and tie them securely, as shown in Fig. 10. If using an ammonia explosive in wet work, roll the tied primer in box lining paper and smear well with soap or grease.

Priming with delay electric igniters should be done in the same manner as recommended for cap and fuse priming. In loading primers made with long delay igniters, care is necessary to avoid kinking the fuse or crushing the copper shell which houses the rather delicate firing element. The best procedure is to follow the primer with another cartridge or with a dummy of stemming and to arrange the primer and the cartridges or dummies to follow at the mouth of the hole in such manner that they can be pushed back together, as in Fig. 11.

All the methods of priming recommended are based upon two principles: first, placing the detonator so that its greatest force will be exerted upon the charge of explosive, not upon the stemming or the walls of the bore hole; and second, protecting the fuse or the wires from injury. Painstaking application of these principles will aid in reducing misfires and in securing maximum execution from the explosive.

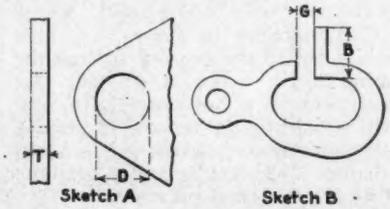
Safety Hook Stays Hooked

USE OF the simple safety hook described in the following may be found advantageous where it is necessary to attach or detach a cable or chain repeatedly to a car or bucket, according to Clifford Corp, of Warren, Ariz. The hook can be quickly attached and a slack and jerking cable cannot shake it loose. It is without troublesome springs or moving parts. Muck and rust scarcely impede its operation.

This device was developed about ten years ago at an Arizona mine to replace an unsatisfactory method of connecting the cable to the bucket in shaft-sinking operations. A short length of chain was placed between hook and cable to give the necessary flexibility to permit a man to unhook from the empty bucket and hook to the full one.

A hole drilled or bored in a plate or bar of definite thickness is necessary on the bucket or car to be attached. This is illustrated in *A*. The hook, sketch *B*, can be of conventional shape, except that the gap *G* should be just wide enough to slip over the thickness *T* of the plate. Also, the point of the hook is drawn out into a bar, *B*, slightly less in length than the diameter *D* of the hole in the plate.

An Arizona mine hook



Digest of Current Literature

Nitrate in Africa. *Chemistry and Industry.* Aug. 23, 1929. At the recent Cape Town meeting of Section B (Chemistry) of the British Association for the Advancement of Science, J. Smeath Thomas reported that there is apparently in Southwest Africa a large area (10,000 square miles or more) of nitrate deposits, with a sodium nitrate content ranging from 2 to 20 per cent. His statement is made on the basis of examination of outcrops on an arid plateau in the Gibeon district. This plateau is traversed by three dry river beds about 100 miles apart. The cliffs along all three contain nitrate. The depth of the deposit varies, sometimes extending from near the bottom to near the top of the cliffs. Geological indications suggest the probability that the deposits would become richer as working progressed inward from the face of the cliff. These deposits in the rock are looked upon as primary formations. Large quantities of much richer nitrate mineral also exist in the river beds. They are considered to be secondary deposits, eroded from the cliffs. Samples from these secondary deposits showed 40 to 86 per cent nitrate content. The iodine content and the phosphate content have been quite low in all the specimens examined. If the deposits measure up to their present indications of commercial value, they could be successfully worked. The railroad now passes within 50 miles, and could be extended. Though in a dry country, the supply of underground water is ample, at depths of 200 to 400 ft.

Beryllium. Kurt Illig. *Chemical Age.* Sept. 7, 1929. The history of the production of beryllium metal is reviewed, starting with the post-war investigations of Goldschmidt, which ultimately led to the founding of the Beryllium Research Institute in Germany, under the auspices of the Siemens-Halske Company. Persistent research was required in the practical application of fused salt electrolysis to beryllium production. This led finally to adoption of the double fluorides of sodium and of barium with beryllium for the fused salt bath, following a narrowly prescribed procedure of adding the two double salts to the electrolyte bath. The start is made with the lower melting double fluoride of sodium and beryllium, the barium beryllium fluoride being introduced later. When suitably protected the graphite crucible forms the anode; the cathode is a special iron, made hollow and water cooled. The metal is obtained in reguli of about 150 g., about 98 per cent pure. Its principal impurity is iron from the graphite crucible. The final yield of metal from the raw mineral is about 60 per cent. The investigational program also included a search in various parts of the world for beryllium minerals, with the hope of increasing the supply and lowering the cost. Large deposits are known in the Americas (chiefly in Florida, Canada, and Brazil), and in Europe (Norway, Spain, South Germany, and the Ural Mountains). These are deposits of beryl. The price is considered to be too high; producers still cling too much to the idea that beryl is a semi-precious stone, rather than a commercial mineral. Uses of beryllium metal are numerous, chiefly in production of special alloys and as deoxidizer in copper casting. The detailed story is told in "Berrylium-Arbeiten," recently issued in book form by the Siemens Company and reviewed at length in *Metal Industry* (London), Sept. 6 and 20, 1929.

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Self-Deaërating Siphon. A. Vogt. *Braunkohle.* Aug. 31, 1929. The self-deaërating siphon is a useful improvement over current practice in dewatering mines and the like. Applications of the siphon principle in this field have been quite restricted on account of the difficulties caused by air and gases evolved from the water or admitted by leakage. An illustrated description is given of the construction and operation of the self-deaërating siphon, in single- or multiple-stage formations. Some specific applications are described. These include: a one-stage siphon line to carry water from a quarry pool to a pump shaft 2 km. away; a case of adaptation of a siphon line to the contour of the land by multiple construction; carrying widely fluctuating amounts of water; an installation, with a small starting siphon, used as a vacuum compressor; and deaërating a gravity flow water line, so that the head required for flow was lessened. As an example of the system used as a vacuum compressor, a case is cited in which the water level behind a power dam was regulated, and at the same time the sediment was drawn off from the bottom. It is noted that in the multiple construction each stage can be replaced by an intermediate shaft, having one pipe for the rise of the entering water and another for the fall of the effluent water. This change is desirable when the water to be moved carries a great deal of air. The illustrations include dimensional diagrams of complete installations, and drawings of the piping for various parts of a system.

Zinc Ores. Georg Balz. *Metall und Erz.* September, first number, 1929. For the greatest speed, thoroughness, and economy in roasting sphalerite to obtain zinc metal by distillation, a prime essential is efficient circulation of the roasting gases. This increases the contact of oxygen with ore particles and the rate of removal of sulphur dioxide from the reaction zone. It also lessens sulphate formation by removing the sulphur dioxide as it is formed, and improves the heat utilization of the furnace. For best results, the furnace must be arranged so that the operator can watch the heat and regulate the roasting process accordingly. Some essential features of furnace design for optimum roasting are: low roasting chambers, thin layers of ore, effective stirring and conveying apparatus, adequate provision for air supply and temperature control, and arrangement for maximum heat utilization. For minimum loss by dust formation, the ore as it falls into the roasting chamber should be met by the rising current of hot gas and brought as quickly as possible to the proper red heat. The same conditions which favor removal of the sulphur oxides also favor separation of the volatile metals (lead, arsenic, and antimony) from the zinc. Thus, with properly adjusted temperature and gas velocity, and with the aid of an electrostatic precipitator, separation of zinc from these metals can be effected in the roasting process. Loss of zinc by formation of zinc ferrite is best avoided by rapid roasting at the lowest feasible temperature. A procedure is also described for roasting low-grade mixed or complex zinc ores in preparation for the electrolytic method of zinc recovery—that is, for roasting to form zinc sulphate, which can be leached out. This calls for a low-temperature, non-sintering roasting method.

Gas Masks in Mines. *Revue des Produits Chimiques.* Aug. 15, 1929. The new French code governing provision of gas masks by mines and preparation for their use in emergencies was issued May 29, as an amendment to the general mining law dating back to 1810. The number of masks required to be held in readiness is smaller for mines not producing combustible materials than for coal mines and the like. Detectors for carbon monoxide must also be provided. The law still recognizes white rats or canaries for this purpose, but recommends the use of chemical detectors, which should be sensitive at least to 1 part in 10,000. Specific requirements are stated concerning the instruction of employes in the use of the masks and the designation of officers to be responsible for rescue and emergency work.

Vibrating Screen. *Chemische Fabrik.* Sept. 11, 1929. A new vibrating screen has been designed, with which screening can be effected to a fineness of 4 mm. or smaller particle size. Vibrations (several thousand per minute) are imparted directly to the entire screen surface, vertical to the plane of the screen. The loss involved in imparting them through the frame is thus eliminated. Rate of vibration is adjustable, according to the material being screened, by regulating the pressure through a valve in the air line, the vibrator being driven by compressed air. The machine is adaptable for use either single or double, for dry or wet screening.

Chrome in Pyromorphite. G. Carobbi and F. Alfani. *Giornale di chimica industriale.* June, 1929. Occurrences of yellow pyromorphite have been attributed to presence of chromium as chromate. Chromate chromium has actually been found in a yellow pyromorphite from Leadhill, Scotland; and the possibility of making synthetic pyromorphites containing up to 6 per cent of lead chromate has been demonstrated. Yellow pyromorphite from Gennemari has also been analyzed, and together with a slight chloride deficiency has shown the presence of a small amount of chromate chromium, corresponding to approximately 0.5 per cent of lead chromate replacing lead chloride in the molecule.

Copper and Oxygen. F. J. Wilkins. *Zeitschrift fur Elektrochemie.* August, 1929. Experimental evidence shows that when copper is heated to high temperatures, penetration of oxygen through the oxide film occurs both by diffusion of oxygen through the lattice and by diffusion along grain boundaries. The latter, however, is small in comparison to diffusion through the lattice. The oxidation follows the general parabolic equation quite closely. Data are reported for oxidations carried out at 850, 950 and 1020 deg. C.

COMMENT AND CRITICISM

Let the Reader Beware of Statistical Pitfalls

To the Editor of "E.&M.J.":

In the path of the reader of technical literature who is interested in production statistics, particularly from foreign sources, there are many pitfalls. The writer ventures to call attention to some of these difficulties, in the hope that, by bringing them into the limelight, both their frequency of occurrence and their misleading effects may be in a measure abated.

In first place is the question of mine production, smelter production, and refinery production. Some metals are reported in two or more of these forms, and it is occasionally difficult to differentiate between them, particularly if the data are not secured directly from the original source, owing to inaccuracies in labeling an item exactly as it passes successively through different publications.

Another type of conflicting data is found where several agencies are covering the same field, as where private or state statistical bureaus or trade associations duplicate the work of the governmental statistical agencies. Owing to the different methods of collecting and tabulating the data, figures from these various sources seldom check exactly, and not infrequently they differ by considerable amounts. Then, too, in many instances where a material delay in compiling complete figures is encountered, and in others where no regular statistics are collected, estimates are made, and these vary widely, depending on the skill of the estimator and the completeness of the information available.

Another matter that occasionally makes trouble is the fact that, although the statute ton of the British Empire is the long ton of 2,240 lb., some of the British colonial territories do not use this officially, but use the short ton, and inasmuch as it is a common failing in many governmental publications to give information as to the units used in a very inconspicuous fashion, and sometimes even not at all, the determination of the units used is occasionally difficult.

These difficulties are supplemented by the necessity of differentiating between the various units of weight in common use; the same material will be listed in long tons in one country, in short tons in another, and in metric tons in a third, and, when information is passed from one country to another, the units are not always clearly designated. For example, it is not at all difficult for one who is familiar with the problem to imagine finding in a January number of some English periodical an item reading somewhat as follows: "Our local correspondent reports that the tin production of Bolivia last year was 66,138 tons. Due to excessive rainfall some of the outlying districts met with considerable difficulty in transportation, resulting in a slight decrease in output from the previous year."

To the uninitiated this may seem like a clear-cut statement of the Bolivian output in 1928, but let us dig a little below the surface. First, what kind of tons are meant? Bolivia uses the metric system, and the original report was presumably in metric tons; has the English correspondent reported it as such, or has he converted it into long tons? Was the amount originally reported by the Bolivian authorities 66,138 metric tons, or was it 67,230 metric tons, which the correspondent has converted into 66,138 long tons? The next thing that strikes us is that Bolivia has never produced more than 30,000 to 35,000 tons of tin in a year, and that the figures given must therefore be not the actual tin production, but the tonnage of concentrate, or *barilla*. But, inasmuch as the tin content is not specified, there is no way of finding the tin production, except by approximate comparison with the tin content of the *barilla* in previous years. A little searching gives us the information that the tin content of the *barilla* shipped was approximately 60 per cent in 1925, 57 per cent in 1926, and 55 per cent in 1927. What was it in 1928? Did the decline in grade continue, or not? Shall we use 55 per cent to get an approximate figure for 1928, or shall we drop to 54 or 53 per cent?

And finally when we come to compare the figure given with the statistics already on file for previous years, we find that it is suspiciously similar to the preliminary figure that has already been given for 1927, and that it is less by a few hundred tons than the figure for 1926. Also, we remember that all the current reports during 1928 indicated an increase in production, rather than a decrease. We are finally led to a decision that this is an attempt to give the final figures for 1927, and not the preliminary figures for 1928, and that we have been misled by the indefinite reference to "last year," overlooking the fact that although the report was printed in January, 1929, it was probably written by the Bolivian correspondent in November, 1928. A little care on the part of the contributor and the editor would have eliminated all of these difficulties, and left a clear, straightforward piece of usable information.

These are only a few of the more outstanding difficulties that one meets in trying to use statistical data, but they indicate rather decidedly the desirability for greater care on the part of all concerned with the publication and dissemination of such data, so as to avoid the spreading of incorrect and misleading information.

G. A. ROUSH.

Bethlehem, Pa.

Bibliographies and Technical Research Endeavor

To the Editor of "E.&M.J.":

In an article in your issue of Sept. 7 last, reference is made to the advocacy by *Nature* that bibliographical research should precede experimental investigation, and it is said that bibliographical research is fruitless for those undertaking an investigation "that will provide a *new* method, process, or other technical achievement *hitherto unknown.*" The italics are mine. That anyone would disagree with such a statement can hardly be supposed. The only object of bibliographical research is to ascertain that the method, process, or technical achievement is really new. I do not wish to vouch for the exact figure of 50 per cent, quoted as the proportion of research work that is wasted for lack of information. The position is worthy of further study. But it seems probable that a large proportion of those engaged in experimental work, in the belief that it is new, are really repeating what has already been done, and this applies to workers in all countries of the world, not merely to those in Great Britain.

It is with the object of limiting this waste of energy that the many abstracting and bibliographical periodicals are published. But, at the present time, only a portion of the literature is indexed, so that research workers are unable to ascertain all that has been done in their particular subject.

At the recent conference of the Association of Special Libraries, at Cambridge, Sir J. J. Thomson spoke very much to the point when he called attention to the inadequacy of the subject-indexes to bibliographical material, which indexes he considered to be of more importance than abstracts. Probably, as Sir J. J. Thomson said, it is not advisable for a research worker to consult the literature until he has thought out his idea from all points of view. But, when he has done that, he should make a complete bibliographical research before undertaking any considerable investigation.

I am obliged also to disagree in part with the concluding sentence of the article, which says that "Bibliographies are of value in the acquisition of general information; those who are advancing the borders of scientific knowledge have little opportunity or necessity for looking backward." It seems to me that, for the acquisition of general information, bibliographies are particularly inconvenient, and that they are intended as a means of gaining access to special information. It is an unfortunate fact that research workers have insufficient opportunity for consulting bibliographies, because, unfortunately, complete bibliographies do not exist. Moreover, for the few men of exceptional ability who have been working for a considerable time on subjects of limited scope, there is not great need for bibliographical research. Nevertheless, for the majority of those engaged in scientific and technical investigation, there is no way of escaping much unnecessary expenditure of energy, time, and money, except by reference to complete bibliographies of their subjects of study.

My object in stressing this point is the hope of reducing the present waste of energy in avoidable experiment by enlisting the services of bibliographers in a combined attempt to produce a complete index to the literature of research. Such an index can be prepared by the rationalization of the bibliographical work now being expended in individual effort that is not co-ordinated. Merely for lack of co-ordination, no comprehensive index to the world's scientific literature at present exists, but such an index will not be produced until the need for it is realized.

S. C. BRADFORD.

Science Library,
London, England.

[*Engineering and Mining Journal* is in hearty agreement with Mr. Bradford's contention that a comprehensive index of the world's scientific literature would be of inestimable value. As he points out, however, in technical research, recourse to such a work would be made only to determine whether or no the object of a tentative research program had already been achieved. This determination might well be undertaken by those directing research rather than by research workers themselves. His other contention—that bibliographies are intended as a means of obtaining special information rather than general information—depends entirely on the utilization made of a bibliography. The useful information that might be gained from such a source by a research worker engaged on a new problem would undoubtedly be general in character.—EDITOR.]

Treating Cupriferous Gold Ores

To the Editor of "E.&M.J.":

I wish to thank Mr. Bertram Hunt for calling attention in the issue of Oct. 12 to his ammonium cyanide process, which was unintentionally omitted from the article on "Treating Cupriferous Precious Metal Ores." Mr. Hunt's statement that there appears to be no call for methods of handling cupriferous materials by cyanidation is certainly true when consideration is given to copper concentrates only. There are, however, conditions in Canada where a high-grade copper concentrate can be made by selective flotation, and it is found that the precious metals go largely with the iron sulphides into the tailing. This is true of Flin Flon, for example, and of certain copper-gold ores in northwestern Quebec. In some instances it may prove profitable to make a high-grade copper concentrate, but a lesser amount for smelting, and then to cyanide the tailings. By ordinary methods, the consumption of cyanide on material containing up to 0.5 per cent copper as chalcopyrite, such as copper-concentrator tailings, is very high; the more copper present, the higher the cyanide consumption. To point out some of the problems in treating cupriferous material by the cyanide process was the object of the article.

A. C. HALFERDAHL.

Ottawa, Canada.

Plight of the Kaolin Producers

To the Editor of "E.&M.J.":

Only recently Americans have come to appreciate the quantity and quality of kaolin to be found in the United States. The World War had given domestic producers a chance to overcome prejudice on the part of consumers in favor of imported clay and to prove that they could maintain regular shipments of a product uniform in grade. After the war they maintained their hold upon the market, although in 1924 price-cutting by foreign competition threatened to shut them down. In 1926 prices were stabilized at a higher level. At this time imports and domestic production were about equal. Increased demand since then has been met by the domestic producers. New capital has been attracted. A few of the braver enterprises have made heavy investments in plant equipment in order to lower costs, better their grades, and produce on a large scale. In the South, it begins to look as if an important industry were being created.

To secure needed funds for further improvements and to make it possible to invite investors to participate at not too great a risk from foreign competition, and on equal terms with other enterprises, the producers asked Congress for a $1.25 increase in the tariff. The present tariff is that established in 1897. But in direct opposition, an unexpected blow was struck at this infant industry by the Senate Finance Committee when it proposed a reduction of $1 per ton in the existing tariff.

If ever an industry deserved and needs protection, it is the kaolin producers. Most of the companies are struggling along, trying to make both ends meet. Many have given up the ghost because the chances for profit are too slim, the margin is too narrow and the risk too great. A few have gone on, but now they also are threatened with ruin.

It is obvious that this was purely a political move by one party to force the other party to trade. The move may have been clever, but it will kill the domestic kaolin industry if the proposed cut is made effective.

D. FORD MCCORMICK.

Staunton, Va.

Recognition of Credit

To the Editor of "E.&M.J.":

My attention has been called to an omission in my recent article on aërial prospecting in northern Canada. In mentioning only Gordon Duncan's name, and leaving out the names of J. E. Hammell, Captain Oaks, and others, I seem to have been unfair to many others whose splendid work was largely responsible for the success of the company. This omission was not intended as a slight. Mr. Hammell organized and financed the company a year before Mr. Duncan was connected with it, and Captain Oaks organized the aërial branch of it. They established all their caches and did 100,000 miles of flying last year over new territory, making one important find at Pickle Lake before Duncan came into the picture.

However, my article was so specialized that it dealt only with the present prospecting methods of the N.A.M.E. from the prospector's and miner's point of view—a thing that I understand was largely Mr. Duncan's share of a very big piece of work.

I do not want to give the impression of desiring to slight either Mr. Hammell or Captain Oaks. Without their energy and vision, the N.A.M.E. simply would not exist. But any mention of them in my article as it stands now would have had to be merely in passing, and any discussion of their work would have made an entirely different article out of it.

EARL HANSON.

New York, N. Y.

BY THE WAY

The Prospector and His Problems

High Finance Exposed—An Outline of Procedures That Should Be Avoided in Raising Funds for Promotion and Development

A. C. GILMORE, of Prescott, Ariz., in a talk at a recent meeting of the Yavapai County Chamber of Commerce, discussed in a humorous vein some of the problems of the "hill-billy" or "desert rat" type of prospector. The first of these the modern prospector solves by getting a paying job until he has accumulated enough to buy grub, tools, and a flivver. Next he must find an ore deposit with sufficient grade and tonnage to pay, a matter of perhaps a few years. The third problem is to obtain financial help for development, and in this the prospector, even if experienced, has a difficult time to evade the human spiders who are continually spinning their webs for him.

"Our prospector," says Mr. Gilmore, "goes to town, having first duly monumented and done the initial work upon the Good Faith and other claims. In the lobby of the best hotel he gets into conversation with Mr. Fatwad, reputed financier. 'Yes, I can finance the property by forming a corporation, but I want 51 per cent of the stock,' says Fatwad. At first Prospector thinks that, as he is owner and has thus far borne the entire burden, he should get at least one-half interest in the company's stock. But it is explained that in consideration of the extra 1 per cent of the stock, Mr. Fatwad will pay the expense of organizing the company. Prospector, anxious to make a deal, says to himself, 'Well, 1 per cent isn't much anyway.' So he consents. Suggests Good Faith Mining Corporation as the name of the company. Fatwad says, 'Fine: That sounds fine.' His smile indicates derision and humor, as well as pleasure, but Prospector does not notice that; is himself in excellent humor, indulges in prophecies as to the big mine they will make.

"A deed conveys the property from Prospector to the company. Prospector finds that the board of directors consists of Fatwad, Fatwad's wife, Fatwad's stenographer, Fatwad's bookkeeper, *and* Mr. Prospector. Fatwad is in control. Work is started under Fatwad's direction. Later it is found that money is not forthcoming to pay miners and merchants. Prospector has beautiful stock certificates, but no money. Some fine day he reads in the local paper that the company's holdings will be sold by the sheriff at 10 a.m. at the north door of the courthouse. Prospector witnesses these obsequies—broke. Fatwad also is there, as planned from inception of this and other companies and bids in the whole property for a debt not at all commensurate with its value. The months pass, as does title to the ground. Prospector finds that his Good Faith Mining Corporation is succeeded by Merger Mines Company, Inc., a company in which he has no ownership, although still interested—as an onlooker. Prospector remarks: 'That Financier Fatwad is sure a merger, all right! He merged my 100 per cent ownership into 49 per cent, did the same thing with Chuchawalla Bill's Rattler group and with Burro Sam's R.A.M. group, then chucked 'em all into this Merger thing. Merger ain't a strong enough word—I'm plumb submerged! Next time I'll do the financing myself; organize a company at my own expense, and keep control.'

"So back to the hills he goes. Locates another group, works for wages, saves about $1,000. Tries to start a company; finds he does not know how, so hires a lawyer. 'You must have articles of incorporation,' says the lawyer. 'All right,' says Prospector. Lawyer steps into next room and speaks with Miss Stenog, who trots downstairs. Prospector is told to come back next day. Miss Stenog goes to recorder's office, is handed one of sixteen volumes of recorded articles of incorporation, copies one of them which fits the case except as to names and dates. Elapsed time of Miss Stenog, two hours. Next day Prospector pays $50 for the job. He is paying for about $2 worth of actual work, the $48 being for brain fag sustained by the lawyer. Then follow bylaws, and application to Corporation Commission for permit to sell stock. Sounds profound, mysterious, difficult, to Prospector. But as there are tons of carbon copies of such documents available Miss Stenog simply has another job of copying. Lawyer's brain fag again assuaged. This time it cost Prospector the savings from a month's wages when working on a bean diet.

"Prospector then goes to Phoenix to square his company with the Corporation Commission. His company, like other mining companies, is by Arizona and California laws presumed to be guilty of fraudulent intent until proved innocent of such malicious purpose by the payment of fees to the Corporation Commission. Well, he pays, and gets his permit. Cost him about $100; lawyer cost him $200; is out about $360, and not a share of stock sold.

"He tries to sell stock. He is not a good salesman; does not look prosperous, for he had to pay for red tape instead of for good clothes. Concludes, finally, that he will have stock sold on commission. Sees in a reputable paper printed in Los Diablos, Calif., the advertisement of an outfit of individuals stating that they are prepared to conduct the details of financing new corporations. Prospector writes them. They answer, outlining their methods but promising nothing definite. State that they cannot do so until they have threshed the matter out with him in person. Will he please come to their office and confer? His company has no money to defray such expense, but he goes. Is impressed by the handsome furnishings, the bevy of handsomer stenogs, the suavity of the manager, and the general aspect of prosperity. Is told about the New York branch, with big clientele; and the great volume of money available in California from movie stars and retired capitalists, the manager verbally insinuating that their bank accounts are on tap for him and that he is their trusted advisor in matters financial. Yes, they have employees who are gifted writers of prospectuses and follow-up letters; in fact, have all modern facilities for conducting a stock-selling campaign. For $1,000 they will prepare and mail such literature, and will charge 20 per cent upon stock sales made directly by their salesmen. The $1,000 is too big for Prospector's pile, but he has $600 left. Compromise effected by cutting down amount of mail matter. Prospector hands over his $600. Receipts from stock sales are, according to his understanding, to be placed to credit of his company.

"Sounds fine to Prospector, so he goes back to his claims and does a little work on roads and trails, awaiting the arrival of funds. Weeks pass; no funds arrive, Excuses and explanations from the financing agency as specious as their offices were spacious. Prospector reads his contract critically, carefully. Finds that nothing is guaranteed except that they will write and print a prospectus, mail certain form letters, send out stock salesmen to *try* to sell the company's stock. Prospector runs across a printer friend. Is told that prices charged were very high, even if he were sure the full number were printed and mailed as agreed upon. Prospector, under an assumed name, sends for literature of other mining companies which had, like him, contributed toward the prosperity of the financing agency. Found a remarkable similarity in them. Printer looks them over. 'A lot of pick-up in these,' says he. 'Guess their printing office keeps the forms standing for the next sucker that comes along.' Prospector soliloquizes: 'For Financier Fatwad, in the Good Faith Mining Company deal, I was the fly. He swallowed me whole. In this financial agency's alleged attempt at financing, I am surely the goat—and now my printer friend insinuates that, in addition, I am also a sucker.'"

Personal Notes

L. A. Decoto has returned to his home at Berkeley, Calif.

Col. **C. H. McNutt** is at the University Club, Montreal, Que.

F. M. Estes, general manager of Dolores Esperanza, is in New York City.

E. E. Barker, mining engineer for Utah Copper, sailed from New York for London recently.

C. Lorimer Colburn, secretary of the Colorado Mining Association, Denver, was in San Francisco recently.

Claude P. Barber has been elected president of the Chamber of Mines of Southern Peru, which was formed recently.

William G. Norrie, of Vancouver, B. C., announces his removal to new offices at 912 Hall Building, Pender and Howe Sts.

E. J. Collins, of Calumet, Mich., vice-president of Calumet & Arizona, was a recent visitor at the company's property, at Bisbee, Ariz.

Daniel Harrington, chief of the safety division of the U. S. Bureau of Mines, was in Salt Lake City recently, on a visit of inspection.

Burr Wheeler, general manager of Chile Exploration, sailed for South America on Oct. 24, after several weeks in New York City.

F. Ward Paine has been elected president of Copper Range, to succeed his father, the late W. A. Paine. **Stephen Paine** has been elected a director.

Enoch Perkins, of Noumea, New Caledonia, will be at Sandpoint, Idaho, until the end of December, when he expects to come to New York City.

Charles Bocking, who is president and general manager of Granby Consolidated, returned to the Coast this week after a business trip to the New York headquarters.

Fred G. Carstarphen, of Denver, Colo., was recently awarded the Arthur M. Wellington prize by the American Society of Civil Engineers, for his paper on "Aërial Tramways."

Hugo Neu, of M. Lissauer & Company, Cologne, Germany, arrived in New York last week on the "Majestic." He is at the office of the Lissauer subsidiary, Associated Metals & Minerals.

F. W. Draper has returned from Mount Isa, Queensland, Australia. He will visit metallurgical plants in the United States in the interests of Mining Trust, which has the controlling interest in Mount Isa.

W. J. Coulter, superintendent of the Climax Molybdenum plant, at Climax, Colo., recently entertained fifteen members of the Colorado section of the A.I.M.E., at a luncheon served at the plant by the company.

E. A. Julian, president of Base Metals, will direct development work at the Berengeria Mines property, near Kootenay Lake, B. C., which Goldfields Consolidated and Mining Corporation of Canada have under option.

G. C. Mackenzie, secretary and treasurer of the Canadian Institute of Mining and Metallurgy, delivered at Vancouver, on Oct. 22, an address on mining conditions in Canada on the occasion of the fortnightly luncheon held jointly by

G. C. MACKENZIE

the mining bureau of the Vancouver Board of Trade, the British Columbia Chamber of Mines, and the British Columbia branch of the Canadian Institute of Mining and Metallurgy.

F. S. Nicholas has been appointed mine superintendent of Granby Consolidated, in place of **J. A. Swanson,** who has resigned. **H. E. Doelle** is advanced to the position of assistant mine superintendent.

E. V. Pannell, formerly technical advisor to the British Aluminium Company, in New York, has left the United States to become manager of the London Aluminium Company, at Birmingham, England.

J. B. Stitt has been appointed sales representative for the Garlock Packing Company for all South America except Venezuela, Colombia, and the Guianas. He expects to sail for Buenos Aires early in November.

Dwight E. Woodbridge, of Duluth, directing engineer for Fremont Grant, and president and engineer of Amalgamated Industries, both of California, has resigned from the presidency of the latter company.

John R. Reigart, vice-president and general manager of Iron Mountain Lead & Zinc, calls attention to the fact that the Ford Motor Company is not affiliated with his company, all announcements to the contrary notwithstanding.

Oliver C. Ralston, director of research for United Verde at Jerome, Ariz., recently visited the Montana School of Mines at Butte. He made two addresses, one to the graduate seminar, and the other to the general student body.

R. L. Agassiz, chairman of the board of directors of Calumet & Hecla, has been re-elected to the presidency of the Copper and Brass Research Association. **William A. Willis,** manager of the Association, was also among the officials re-elected. Mr. Agassiz and Mr. Willis are entitled to great credit for promoting the expansion of copper consumption so successfully in the last few years, and their re-election is well deserved.

At the recent annual meeting of the Tri-State Zinc and Lead Ore Producers' Association, the following committees for the coming year were announced: Executive: **Frank Childress,** chairman; **George W. Potter,** Eagle-Picher Lead; **C. F. Dike,** Interstate Zinc & Lead; and **John Robinson,** Commerce Mining & Royalty. Finance: **P. W. George,** chairman, Federal Mining & Smelting; **A. M. Gaines,** New Chicago Mines; **M. F. Owens,** Black Eagle Mining; and **W. T. Landrum,** Cortez-King Brand Mines. Membership: **F. N. Bendelari,** chairman, Consolidated Lead & Zinc; **George Provine,** Tulsa Lead & Zinc; **C. W. Nicolson,** Canam Metals; Mr. Gaines, and Mr. Landrum.

J. A. Swanson, superintendent of the Hidden Creek mine of the Granby Consolidated Mining, Smelting & Power Company, of Anyox, B. C., resigned on Oct. 16. For about thirty years he had been an employee of the company. Mr. Swanson is a man of wide practical experience, sagacity, and good horse sense. Under his supervision and with his expert assistance the glory-hole and shrinkage-stope systems used at this property were developed to their present successful state. He leaves the company with the highest regard of his associates, who gave him a substantial testimonial upon his resignation, and with the kindliest feelings of the company officials who are appreciative of work well done.

OBITUARY

A. B. Carsten died in San Antonio, Tex., on Oct. 24. Mr. Carsten's death was caused by a broken back sustained in a mine accident about five months ago, in Mexico, where he was engaged by Peñoles Mining, a subsidiary of American Metal. The body was buried in Denver, Colo. His widow survives him.

William S. Noyes, mining engineer, of San Francisco and a member of the A.I.M.E. since 1884, died Oct. 17, 1929, in Oakland, Calif., where he made his home. He was a native of New York and a graduate of Columbia University. For several years he was general manager and vice-president of Presidio Mining, of Texas, and also president of El Oro Dredging. He was a successful engineer and manager. Throughout his career he was helpful to many, and especially to young men. Surviving him are a son, F. B. Noyes, of Vacaville, Calif., and a daughter, Emily L. Noyes, of Santa Barbara, Calif.

Dollars in the Scrap Pile

BY WAY of throwing the spotlight on the subject of waste prevention, the Steel Corporation last year dedicated the third week in each October to a waste-prevention drive in all its plants. Recently an official told how the plan had worked since its inception.

Suggestions had been received by thousands, a few of them excellent, and about one in seven or eight sufficiently meritorious to be classed as good. The great majority were indifferent or already in effect, the former predominating—a not unusual result where employee suggestions are invited, although one to be expected, inasmuch as worthwhile ideas do not grow on every bush. But, at that, the number received was large and more than paid for the orignal effort.

The Drive's Result

A summary of results is suggestive. In addition to stimulating committee work on waste prevention and to giving employees a better understanding of the problems of management, the plan has resulted in a closer inspection for obvious or well-defined wastes; in more intelligent salvage of small items; closer inspection of discarded tools before scrapping; better sorting of nonferrous and other miscellaneous scrap; better control of materials and tools that tend to become scattered; increased use of short-length materials; and more intensive study of reclamation possibilities for items previously deemed worthless. It has also caused employees to take a greater pride in keeping the plant clean. In short, it has to some extent created a local sentiment against waste, wherever discernible, and indirectly against disorder and dirt.

Waste is not limited to the scrap pile, which is merely one of its results. More than the value of supplies and equipment scrapped may be lost in other ways, as in leakage of steam and water and loss of heat through improper insulation. Lubricants and other supplies may be used extravagantly and may not be reclaimed where this is possible. Light and power also may be wasted through needless use. In all these things, although the evidence be destroyed, the waste may amount to a pretty penny.

Broadly viewed, the subject of waste leads directly to consideration of the efficiency of operation and management. Inefficiency spells waste. Waste in ordering supplies has already been discussed (*E.&M.J.*, Sept. 21, 1929, p. 480). For the present, the scrap pile will be considered. At most plants it will bear some picking over. Recovering usable material found in it, preventing the pile from growing needlessly, and reducing scrap to metal where no other means of avoiding waste is open, are aspects that merit study.

Junk and Frailty

Scrap or junk seems to bear some relationship to human shortcomings. In the junk business, as often noted by the courts, is found one of the roots of juvenile delinquency, many a young person having at some time come to grief through appreciating too keenly the scrap value of metal fixtures found in vacant houses. Likewise, the scrap piles of some plants might tell sad tales of reprehensible waste out of which they grew to their present dimensions—a waste not always discernible through its covering of rust.

Sandy MacTavish, the canny mechanic, suggests sorting the scrap pile and returning everything of value to stock. For years he's been drawing on it in a pinch and has always found what he wanted.

No Ornament

At its best, the scrap pile is unsightly and tends to demoralize the orderly, efficient workmen. The smaller it is, the better on all counts. Some scrap there is bound to be about a plant. It comes from various sources: shop sweepings, turnings, and odds and ends left over in cutting up materials; gleanings from pick-up magnets, and worn-out and unusable equipment. To the scrap that thus with good excuse accumulates other material may at times be added, perhaps to hide some uncorrected error in ordering supplies, or because some one is tired of seeing it lie around. Here delinquency of someone clearly enters.

From such industrial waste grow the fortunes amassed by junkmen. The operator often loses more than the junkman wins, for the latter recovers only the value of the material, whereas the operator loses part of the manufactured value. The part scrapped might possibly have been used by some other department than the one responsible for discarding it.

A simple illustration is to be found in the nails, bolts, and spikes recovered from the mine ore by the pick-up magnets at a Western crushing plant. At small expense for sorting into nail kegs, these are returned to the mines as good as new except for being rusted. Every keg thus saved is practically equivalent to a new one purchased.

Existence of valuable material in the scrap heap is often recognized by employees, although no steps to recover it may have been taken by the management. Shopmen naturally draw on it from time to time, whenever an odd piece of metal is desired for some special purpose. In such cases less missionary effort should be required to reduce the waste involved.

Welding vs. Scrap

Less reason for accumulating scrap metal exists today than formerly. One important factor has been at work to keep the size of the scrap heap down. This is welding. Its advantages in remote districts have been enormous. With its aid, heavy machine castings have been repaired and worn parts built up—work formerly impossible at the plant, the latter, moreover, often being too far from the manufacturer to warrant shipping the parts to him for repair or reconditioning. In such cases, generous additions were bound to be made to the local scrap pile. Welding has decreased the amount of scrap, at the same time increasing the active life of the machinery repaired.

In large plants, however, especially in large groups of mines under one management, despite the use of welding, the amount of material of more than scrap value that finds its way to the scrap heap is large. Waste occurs in many ways. Workmen are likely to be wasteful in cutting up material. Metal is not the only scrap, of course. One engineer tells how, in repairing mine hose, the workmen would carelessly use an axe instead of a knife in cutting out a break and thereby waste some 5 or 6 in. of hose on each occasion. Or the mine or mill may no longer be using a material regularly stocked and may have failed to notify the warehouseman to this effect. In consequence, this particular supply becomes obsolete in the

course of time, and eventually is scrapped.

The engineer referred to cites further observations made while prowling about his rather extensive bailiwick. He tells of seeing usable ends of bars from forge shops; valves and other scrap of brass, pipe, and fittings; cotton waste; lubricants, high-speed steel; hose; packing; tools—all of which were apparently destined for the scrap pile. In any one department, the amount of waste may be so small as to seem unimportant. Multiplied many times, however, it makes a respectable total. For this reason, whether or not a melting furnace be employed, scrap should be brought together in one place and carefully sorted before being finally discarded, in order to avoid unnecessary waste.

Salvage and Centralization

This will suggest to some, as it did to the engineer, the idea of a central salvaging department. Centralization is the first step to efficient reclamation. The engineer's company, one of the important copper producers, has organized such a department under his supervision. In addition to preventing or at least exposing ordinary waste caused by carelessness, and to keep usable parts from being junked, the function of this department is to prevent the waste of material purchased but no longer needed owing to change in practice. Properly functioning, it makes it difficult or impossible for the other departments to waste supplies without detection.

This salvage department was first established to prevent the waste of rock-drill parts. Previously, each individual repair man decided for himself whether or not to discard a worn or defective part. This is left no longer solely to his decision, which was probably erroneous on more than one occasion. He may discard a part, but thereupon it goes to the new department, where it is inspected and checked for wear with limit gages, and a final decision made as to whether it can be reconditioned, or should be scrapped, or should be returned to the manufacturer as originally defective. Reconditioning and repair jobs thus accumulate in the department and are run through in quantity to reduce the unit cost. This practice, states the supervising engineer, also furnishes useful information as to the general failure of any material and discloses any tendency that may develop on the part of individuals to use material extravagantly.

The Saving

A net saving of approximately $66,000 was effected by the company in 1925 by thus salvaging and reconditioning rock-drill parts previously discarded. In the same period, the value of used supplies transferred and salvaged was a quarter of a million dollars. These supplies might have been used eventually, but failure to transfer them would have called for spending an equivalent amount of new money.

Defects and Refunds

Out of the practice of inspecting rock-drill parts has grown a well-developed system of returning them to the manufacturer for refund, when found to be defective. Careful record of each and every part is kept from the moment it is received in stock. For every part issued a card bearing its number is made out and filed in a rack of pigeonholes under the number of the machine. Every machine has its own pigeonhole. To identify a machine its number is stamped in a blob of brass brazed on it. On the card for any part is entered the data regarding every repair made on that part, including date and comment. Thus the entire history of a machine and its parts is to be found on the cards filed under its number. When after being issued a part is returned for repair, its condition is noted to determine whether it has given the service that could properly be expected of it, or whether its need of repair is due to originally defective manufacture. If the latter is clearly established, the part is returned for refund. Some defective material is of course bound to be received, and it will be a loss to the company unless thus detected and replaced.

Other supplies than rock-drill parts are similarly inspected. Last year the company secured adjustments on material such as drill steel, air and water hose, and drill parts to the extent of $8,000 or $9,000. It has found the manufacturers always ready to make equitable settlements when claims for defective material can be justified by the claimant.

At the Source

From salvaging wasted material to stopping the waste at its source is a logical expansion of the primary function of the department. Working in this direction, it has accomplished the following economy: Instead of purchasing and maintaining stocks of parts at several mines for operating two or three odd types of drills (in addition to the make or models principally used), the company now confines the machines of each of these odd types to a single mine. Some of them are disassembled and the parts placed in the salvage stock, whence they are drawn from time to time to maintain the machines that are kept in service.

Obsolete rock-drill equipment is similarly treated. The old machines are gradually replaced with new, those supplanted being used to furnish parts for the drills retained in service. In this manner the obsolete machines are gradually reduced, only enough of them being kept in service to use up the parts. This, says our efficiency engineer, makes it possible to confine the spending of new money to buying new efficient machines instead of purchasing parts for obsolete drills. He adds that all orders for rock-drill parts are checked against the salvage stock, so that no new parts may be purchased before the old ones have been consumed.

So successful has been this system of reducing preventable waste of drill parts, and preventing inefficient use of money, that thought has been given to extending it so as to apply it to all classes of material. To this end, waste material of all sorts, instead of being scrapped, would be sorted and stored on platforms, where it might easily be inspected.

Eventually, however, irreparable wear or obsolescence will bring most equipment to the point where replacement must be made. Like death, the scrapping stage is not to be avoided. Or possibly a changing flow sheet or the desire for effecting new operating economies in other ways may make advisable the discard of machinery before its manufactured value has been consumed. In either case the management is confronted with the choice of scrapping or selling the equipment. If sale is possible, well and good. The mining company is lucky. More often scrapping is unavoidable.

The Foundry

Here another factor tending to reduce the size of the scrap pile may be considered. It is the foundry, using scrap as raw material. If one is situated near enough to the mining company's plant to permit shipment at a profit of otherwise worthless scrap, the operator has available an economic way of disposing of this material. But where the plant is more remote, the quantity of scrap large, and at the same time a large amount of simple castings is currently required for operation, the company may find it advantageous to install its own foundry or, at least, a melting furnace.

Such practice is not new, of course. Various large mining companies, thus equipped for years past, can be mentioned offhand. The practice, on a modest scale, would be profitable to many companies of smaller size. Casting of grinding balls locally has already been described in these pages (*E. & M. J.*, May 18, 1929, pp. 806-8) and the economy and efficiency of the electric furnace in mine foundries will be discussed in an early issue.

Aside from the advantage of being able to produce simple castings as desired, a foundry or melting furnace insures a cleaner, neater plant. With the aid of the cutting torch large scrap can be cut up so as to be readily handled at the furnace and the unsightly heaps commonly found may eventually be removed.

An Indicator

In general, accumulation of material that is worthless, save for its value as scrap, does not pay, unless it serves to supply a foundry, local or distant, whereby a profit may be realized. Scrap piles of generous size today suggest waste somewhere in the plant and inefficiency and lack of enterprise on the part of those in charge of operations.

A. H. H.

NEWS OF THE WEEK

Summary

INTERNATIONAL NICKEL may mine upper portion of Frood orebody in the Sudbury district of Ontario, with steam shovels or by glory holes. Construction work well advanced and production on large scale may start in 1930. Page 711.

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Construction work at Inspiration, Miami, and Old Dominion, in the Globe-Miami district of Arizona, is practically complete. Miami is now handling 17,000 to 18,000 tons daily. Page 715.

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The Sulphide Corporation has increased its concentrator capacity in the Broken Hill district, New South Wales, to handle the output from the Proprietary and Block 14 mines, which have just been reopened. Page 714.

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Passage of the proposed labor legislation does not seem likely now before the adjournment of the Mexican Congress, as only six weeks remain of the present session. Page 716.

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Four important development projects are now under way in western Nevada. Of these, only the Tybo mine of Treadwell Yukon is in production. Increased gold production in the state may result from work at other three. Page 712.

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Installation of a new electric hoist at Calumet & Arizona's Campbell shaft, in the Bisbee district, is nearly complete. Page 715.

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Trains are now running to the Errington mine of Treadwell Yukon, in the Sudbury district, as construction of a spur railroad has been completed. Page 711.

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Rains in Chihuahua, Mexico, were not of sufficient importance to prevent power shortage, despite contrary reports. Construction of new steam-power plants at Torreon will relieve situation. Page 714.

Dome Mill at Porcupine, Ont., Completely Destroyed by Fire on Oct. 28

Damage to 1,500-Ton Plant Covered by Insurance—Will Probably Be Rebuilt—Cause of Disaster Unknown in New York Headquarters of Company

TORONTO, ONT., Oct. 29.—The milling plant of Dome Mines, Ltd., in the Porcupine district of Ontario, was completely destroyed by fire which broke out at 8:30 p.m. on Monday, Oct. 28. The damage was well covered by insurance. It is probable that the plant, which had a capacity of 1,500 tons daily, will be rebuilt.

In telephone conversation with the New York headquarters of Dome Mines, a representative of the company stated that the cause of the fire is as yet unknown here. The exact extent of the damage is not known either, although admitted to be very serious. No statement could be obtained on the length of time that the mine will be out of production or how soon building of a new plant would be started, as detailed reports from Porcupine had not been received.

The total valuation of the Dome plant, according to the most recent annual report—that for 1928—was $2,976,732, although this of course includes the mining as well as the milling equipment. Production from the Dome mill has been averaging more than $300,000 monthly this year, although recent output figures have shown a slight downward tendency. The plant shares second place among Porcupine producers with McIntyre Porcupine. Production at Dome was started in 1912, but did not reach large-scale proportions until 1916. The company was reorganized in 1923, the present organization succeeding the Dome Mines Company, Ltd.

In the last annual report, Dome's reserves were estimated at 1,250,000 tons, or slightly more than two years' supply. Since then development work has disclosed additional reserves in the greenstone area, but these are of lower grade than the average Dome ore, which is about $7 a ton. Rebuilding of the milling plant may be delayed until results are available from the new McIntyre Porcupine test plant. This plant is operating on a new method of treating Porcupine ore which has been devised by J. J. Denny, McIntyre mill superintendent. If costs are materially reduced by the new process and the recoveries improved, treatment of considerable Dome junore might be profitable. The extraction recently at Dome had been about 95 per cent, as compared with 96 per cent before treatment of greenstone ore began. About 60 per cent of the total was recovered by amalgamation, and the remainder by cyanidation.

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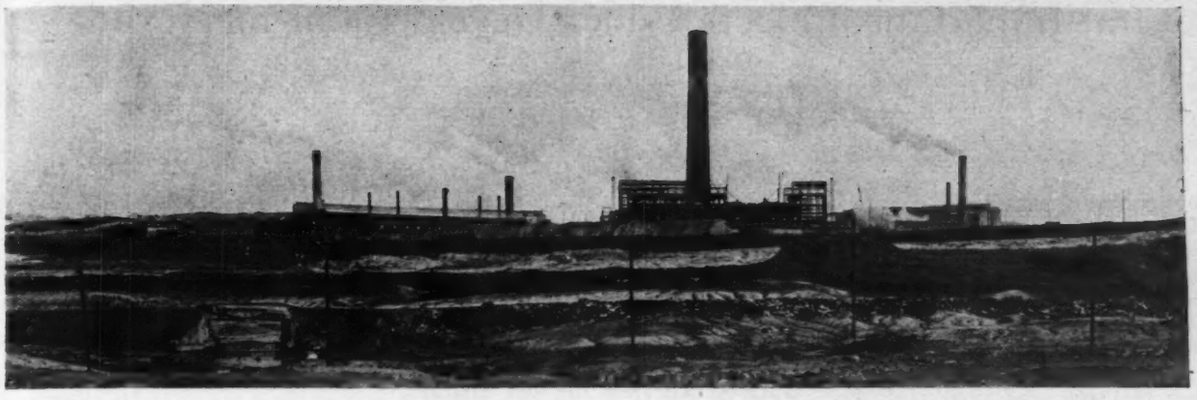
Chosen Corporation Plant Completely Electrified

ELECTRIFICATION of the entire mining and milling plant of the Chosen Corporation, at Donchan, Province of Pyeng-an, Korea, has been completed, according to A. R. Weigall, general manager. In addition, an auxiliary 150-hp. Diesel engine has been installed to avoid any stoppage of electric power that would interrupt cyanide-plant operations. Power from the Chosen Denki Kaisha plant, 115 miles from the mine, was officially turned on June 1 of this year. Previously the company had generated its own power with Diesel engines, and operations had been handicapped by the lack of sufficient power.

At the mine, development work is now under way below the No. 13 level. Ore reserves have been substantially increased. On June 30 they were estimated at 198,850 tons of an average grade of 7.16 dwt. gold per ton, compared with 154,102 tons of a slightly higher grade on June 30, 1928. Drifting east on No. 11 level has disclosed additional oreshoots, the most important being 278 ft. long, 9 ft. wide, and averaging 9 dwt. in gold per ton. The deeper working of the mine will be continued by several small shafts as the orebodies at depth are too widely separated to make one main underground shaft economical. Unwatering of the East Nurupi mine, 2,750 ft. east of the Great Nurupi mine, from which all the tonnage comes, is under way.

At the Chosen mill, about 300 tons are being handled daily as compared with 250 tons before the new power supply became available. Mill recoveries have been improving and the company expects to obtain an 87 per cent over-all extraction. In July, the extraction was 86.06 per cent.



The new smelter under construction for International Nickel at Copper Cliff, Ont. Picture taken early in October.

International Nickel May Mine Upper Part of Frood Orebody by Open Pit

CONSIDERATION is being given the possibility of mining the upper portion of the Frood orebody of International Nickel, in the Sudbury district of Canada, by steam or electric shovels, or by glory-hole methods. This is the territory that was once regarded as the Frood mine proper, in which mining operations were started some years ago, only to be abandoned when discoveries of a high-grade ore were made in diamond drilling the lower levels of the Creighton mine. Only since 1926, when deep diamond drilling at the Frood disclosed the widely discussed phenomenal values in copper and precious metals below the 2,000 level, has attention been again directed to this deposit.

The upper part of the Frood orebody, that is, from the surface to 1,200 ft., consists of a great mass of mineralized material, the mineralization consisting of finely disseminated pyrrhotite and chalcopyrite. At surface the rock content is comparatively high, but diminishes progressively with depth until at about 600 or 700 ft. the mineralization resolves itself into lenses of massive sulphides. For the first few hundred feet in depth, diamond-drilling records showed an average metallic content of about 3 per cent combined nickel and copper. The grade increases progressively down to 1,200 ft., however. At this horizon a crosscut driven from No. 3 shaft showed a width of 100 ft. of ore, averaging 5 per cent combined metals. The metals are found in about equal proportions of copper and nickel.

Below the 1,200 level diamond-drill results, supported by more recent evidence obtained from lateral development, have shown that the sulphides become increasingly massive in character. Down to 2,000 ft. pyrrhotite predominates over chalcopyrite, but from 2,000 ft. downward the chalcopyrite becomes increasingly prominent. Consequently, from surface to a depth of 2,000 ft. the mine will be operated principally as a nickel mine. But below that level the heavy preponderance of chalcopyrite draws attention to its copper content.

The original construction program of International Nickel of Canada called for completion of the new Frood smelter, concentrator, and the Ontario Refining plant early in 1931. Advances which have been made indicate that the smelter and concentrator will probably be completed by the middle of next year, so that sometime during 1930 the Frood will be called on to supply ore at the rate of 6,000 tons per day.

Because of the richness of the lower levels, particularly in copper, the company has decided to concentrate on development of the territory below the 2,400 level. Demands of production between the 1,200 and 2,000 levels will depend chiefly on the amount of nickel required and also on the available supply at Creighton, Levack, and Garson mines. The "cut-and-fill" method of mining has been chosen for use in extracting most of the ore from the lower levels of the mine.

Spur to Treadwell Yukon's Errington Mine Complete

CONSTRUCTION of 6 miles of branch railroad from Chelmsford, Ont., on the main line of the Canadian Pacific, to the Errington mine of Treadwell Yukon, in the Sudbury district, was completed on Tuesday, Oct. 29. Instead of hauling concentrate to Larchwood, 5 miles from the mine, the company can now ship direct from the mine to smelters, and, in the case of zinc concentrate, to seaboard at Montreal. In addition to zinc, copper, and lead concentrates, the company will also dispose of the pyrites, formerly treated as waste, which can be marketed profitably because of the high sulphur content.

Treadwell Yukon is handling 300 tons daily at its concentrator, of which marketable products will be about 140 tons. Up to the present, our Sudbury correspondent is informed, the company has not been penalized in marketing its concentrate.

The Errington plant, originally designed as a 200-ton pilot plant, started operations in April, 1928. By adding crushing machinery and filters, production has been brought up to 300 tons. Total shipments of copper concentrate to date have been about 3,600 tons, and of lead concentrate between 1,200 and 1,500 tons. Zinc concentrate was stockpiled during last winter, and the first shipment was made last June. It totaled about 3,500 tons. Since then about 4,000 additional tons of zinc concentrate have been shipped. Current output is 25 tons of zinc concentrate, 12 tons of copper concentrate, and 3 tons of lead concentrate daily. Pyrites shipments will be about 100 tons daily.

Underground development work has been carried out over an area along the strike of the vein for more than 3 miles, No. 1 shaft being this distance from No. 3 shaft. Nos. 1 and 2 shafts are connected at the 325 level, and drifting is now in progress to connect them on the 500 level. Extensive diamond drilling has been carried out this year from the 500 level at No. 2 shaft, and preparations are now being made to continue this shaft to the 1,500 level. Shaft sinking will commence about Dec. 15.

Meanwhile, diamond-drilling operations will be transferred from No. 2 shaft to No. 3 shaft, 11,000 ft. to the east. Two drills are being set up underground at this shaft, and one drill will be retained at No. 2 shaft for further exploratory purposes. At present about 265 men are employed at the property.

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North Broken Hill Buys Junction Mine

Purchase of the Junction mine of Sulphide Corporation, in the Broken Hill district, New South Wales, Australia, has been announced by North Broken Hill, which took possession of the property Oct. 1. Sulphide Corporation bought the property in 1923 for £75,000 to supply its milling plant while the Central mine was on fire. However, the Junction mine has been idle since September, 1927. Ore reserves and tailing carrying high zinc content on this property were estimated at 385,470 tons.

Several Important Projects Under Development in Nevada

Tybo Mine of Treadwell Yukon First to Enter Production—New Large-Scale Gold Producers May Result From Work at Seven Troughs, Round Mountain, and Gold Hill

A. J. Moore
Nevada Correspondent

FOUR major development projects are under way in western Nevada, of which one has already been successfully brought to production. This is the Tybo unit of Treadwell Yukon, which has been producing since May. The other three are the Cole-Gordon activities at Round Mountain, the Seven Troughs mine, at Seven Troughs, and the Gold Hill, north of Round Mountain. These three are gold properties, whereas Tybo involves lead, silver, and zinc.

The Tybo district, which is in the Hot Creek Range, Nye County, Nev., was discovered in August, 1870. The nearest mills were then at Belmont. The claims that are now the property of Treadwell Yukon produced a small tonnage of shipping ore in the early days, but the appearance of a large zinc content in the ore at depth made profitable treatment impossible. Treadwell Yukon engineers examined the property in November, 1926, and pumping for deep-mine operations was started in August, 1927. About $40,000 was spent in constructing a power line and installing electrical equipment before starting development. After unwatering, the old shaft was practically rebuilt and enlarged to three compartments. It was then deepened from 410 to 700 ft. A small town was built for the employees of the company at the mine, as well as a mill. All the machinery had to be hauled from Tonopah, 60 miles distant and the nearest railroad point. A railroad siding, exclusively for the use of Treadwell Yukon, was built at Tonopah and loading bunkers were erected. About $1,250,000 was spent in bringing the mine into production.

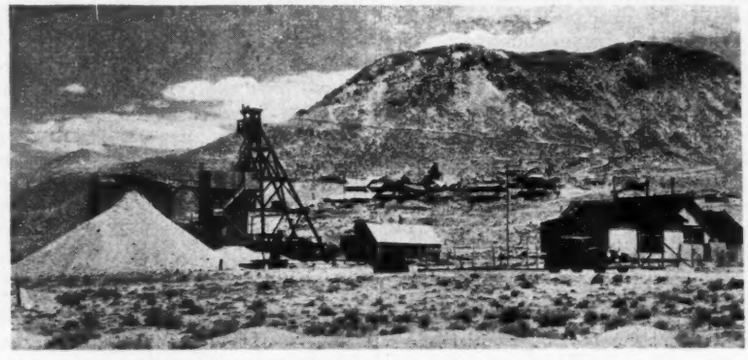
The shaft is now being deepened to the 1,100 level. A station is being cut at 850 ft., and another will be cut at 1,100 ft. when that depth is reached. About 2,200 ft. of lateral work has been done to date. Further development work at depth will depend on results at 1,100 ft. At present ore is being hoisted from the 400, 500, and 700 levels.

About 10,000 tons of ore said to average $22 a ton was left on the dumps by the former owners. Part of this is being treated in the mill, which is handling 350 tons daily, although originally designed for only 250 tons. About 45 tons of silver-lead concentrate and 25 tons of zinc concentrate are being trucked to Tonopah daily by three Fageol trucks, with trailers. A fourth truck will be added by the Golden Gate Transportation Company, which has the contract.

Lead concentrate is sent to the Selby smelter of American Smelting & Refining and zinc concentrate to Sullivan Mining, at Kellogg, Idaho. Production will gradually be increased to 400 tons daily. The mill was built and designed under the supervision of Lloyd C. White, of San Francisco. The flow sheet was published in our issue of June 22.

Treadwell Yukon is credited with paying the highest wages in Nevada. The scale is $6.75 for hoist engineers, $5.75 for miners, $5.25 for muckers, and $8 a day for carpenters. About 185 men are employed.

At Round Mountain, about 60 miles north of Tonopah, the T. F. Cole and L. D. Gordon interests have about 4,000 acres under option. Core drilling has been in progress all summer. Nevada Porphyry Gold Mines was incorporated some time ago to acquire all the companies at Round Mountain, including Round Mountain Mines, Fairview Round Mountain, Fairview Extension, Nevada Gold Development and Round Mountain Homestake. Sale of the properties was ratified at stockholders' meetings this fall.



Mines and milling plants at Round Mountain

About $5,200,000 from lode deposits and $1,200,000 from placer deposits has been produced in the district. The present plan is to mine the entire area with steam shovels, where adaptable, and to mine by glory holes in other sections. Announcement has been made that a 2,000-ton mill will be built to treat the ore by straight amalgamation, which past practice has shown makes about a 93 per cent recovery. The ore is low grade, but estimates on the amount available indicate a large tonnage, particularly in Stebbins Hill, adjoining Round Mountain proper.

About 4 miles north of Round Mountain, Gold Hill Development has proved a high-grade oreshoot, ranging from 3 to 8 ft. in width, over a length of 350 ft. on the 225 level. At the latest report, the west drift on the 400 level had been driven 185 ft. in ore and the east drift had been driven 232 ft., a total of 417 ft., with the east drift still in ore. Work is now in progress on several other veins, paralleling this one. Albert Silver, metallurgical engineer, of Tonopah, has made several tests of the ore and is preparing plans for a mill, the capacity of which has not been announced. The property

The Tybo flotation plant of Treadwell Yukon in Nevada

The Ophir Mono property, near Dry Canyon, Utah

consists of 15 claims. Control was acquired early in 1928 by Clyde Heller, president of Tonopah Belmont Development. Horace A. Johnson, of Tonopah Mining, is general manager of Gold Hill Development.

Seven Troughs Gold is a consolidation of the principal mines of the Seven Troughs district which was effected by L. A. Friedman, of Lovelock. The company's property consists of more than 2,000 acres. A tunnel had been driven 8,245 ft. at last report. Five veins have been cut to date, of which the first, found 5,100 ft. from the portal, has been developed for 600 ft. It averages only 2 ft. wide, but is said to be of good grade. At 8,231 ft. from the portal, the Coalition vein was struck, showing 3 ft. of ore. Within the last 40 ft., two other veins, showing widths of 4 and 6 ft., had also been cut. The tunnel is about 1,100 ft. below the surface at this point.

Drifting has started on the first of the three veins cut around the 8,200-ft. point. By drifting north about 350 ft. along the vein, the company expects to be able to connect with the Tyler shaft. About 340 ft. will have to be raised to make the connection with the shaft, which will serve for ventilation and as an emergency exit for men employed in the mine.

Three 250-hp. Diesel engines furnish power for operations. The first unit of the mill is being built and is expected to start operating about Jan. 15, 1930. Its foundation is now complete. The first unit will have a capacity of 100 tons daily and was designed by Albert Silver.

United Verde Lets Contract for New Houses

United Verde Copper has awarded a contract to the Hogan & Farmer Construction Company, of Phoenix, for the construction of 39 dwellings in Jerome, Ariz. Six of the new buildings will be built on the tennis courts, and the remainder on the north side of Sunshine Hill. There will be three 3-room, fourteen 4-room, and sixteen 5-room houses. The total cost will be about $100,000. Construction will be frame with a stucco exterior.

The new houses will relieve the shortage of homes for company employees which has existed for more than a year and will take care of additional employees who will be needed when the company starts its new three-year program of plant construction.

Reduce Nevada Ore Rates

Effective Nov. 15, the Southern Pacific and T. & T. railroads announce a reduction of freight rates to Utah smelters of 50c. a ton in carload lots of minimum weight of 40 tons. The rate applies to ore or concentrate worth $20 or more a ton. The new rate will particularly affect operators in the Manhattan and Goldfield districts of Nevada.

Base Metals Mill Ready for Trial Run

Completion of the Base Metals concentrator, in the Kicking Horse district, British Columbia, was announced on Oct. 24. Test runs were scheduled to be made about Nov. 1. If no further adjustments are needed, the mill will be started on a small tonnage and gradually increased to the full capacity, 350 tons daily. E. A. Julian, president of the company, reports that the ore bins and all available space in the mine are filled with ore. Little development work has been done during the last ten days, therefore.

Antelope Springs Leads Nevada Quicksilver Mines

Antelope Springs Quicksilver, at Antelope Springs, Nev., is now the largest producer of quicksilver in Nevada. This mine is producing twenty flasks of the metal daily, as compared with about ten flasks produced at both the Nevada Quicksilver and the Pershing Quicksilver plants, also in the Antelope Springs district. Production from the Castle Peak mine, south of Reno, is now about five flasks daily. Since starting the plant on Sept. 5 production up to Oct. 24 totaled 247 flasks.

Barnhill Loses Suit Against Ophir Mono

A VERDICT in favor of the defendant has been given by Judge T. D. Johnson, of the U. S. District Court of Utah, in the suit of R. L. Barnhill against Ophir Mono Mines for $1,500,000. Mr. Barnhill charged the mining company with having taken ore from the Magnolia claims, which he owns. Title to the Magnolia claims was quieted in Ophir Mono, and costs were assessed to the plaintiff.

Ophir Mono has been developing its claims in the Dry Canyon district, near Stockton, Utah, with a view to opening at depth orebodies which were mined in its early days. H. G. Mitchell, formerly with the U. S. Geological Survey, is superintendent and geologist of the property; G. T. Van Winkle is consulting geologist, and M. C. Godbe is general manager.

A two-story bunkhouse is being built near the mouth of the main tunnel in preparation for winter operations. The company has shipped some ore since starting work. Development is being carried on along the Mono bed and the Dry Canyon fissure.

Ontonagon Power Program Now Assured

Contract for the construction of a dam on the Ontonagon River, near the Victoria mine, Ontonagon County, Mich., has been awarded by the Northern Acquisition Company. The dam will have an effective static head of 220 ft. and will develop from 18,000 to 20,000 hp. This hydro-electric development is expected to prove of great importance to the Michigan copper district. The dam is the first of a series that will be built on the Ontonagon River within the next few years.

Shasta Repairs Dredge

Shasta Butte Gold Dredging has started to repair its gold dredge near Thermolito, Calif. The dredge capsized four months ago. Steel pontoons are being bolted to the hull and the mechanical equipment is being reconditioned. The dredge is expected to resume operation on Dec. 1 of this year.

Chihuahua Rains Not as Important as Reported

REPORTS that rainfalls in central Chihuahua, Mexico, had dispelled the possibility of a power shortage in that important mining district, published in *E.&M.J.* of Oct. 5, were not correct, as the rains did not prove to be sufficient to fill the Boquilla dam, operated by Compañia Agricola y de Fuerza Electrica del Rio Concho, controlled by Electric Bond & Share. As the dry season in that territory has now started, not much hope exists for any considerable precipitation for several months, and the supply of power has been curtailed by about 25 per cent.

Fortunately, provision for a large supply of power has been made from a steam power station now being built by Compañia Nacional de Electricidad at Torreon, Coahuila. Work on construction of this plant, and the connecting transmission line, is being pushed on a 24-hour daily schedule. Completion of the initial unit of 12,000 kw. is expected early in January, 1930. The entire plant, with a capacity of 27,000 kw., should be operated in April. Curtailment of supply to the silver-lead-zinc mines of Chihuahua should thus be of short duration. Howe Sound, American Metal, American Smelting & Refining, and San Francisco Mines of Mexico are the most important companies operating properties in the district.

Silver Reef Properties Completely Unwatered

UNWATERING of the Silver Reef properties, in Washington County, Utah, has been completed by American Smelting & Refining. Sampling and mapping of the mines is now under way. The California shaft, 800 ft. deep on the incline, has been pumped dry to the bottom. On the 460 level of the new three-compartment shaft, started about a year and a quarter ago, a connection has been made with the old Savage stopes. Drifting has been done on the 300 level along the White Reef.

At Ophir, Utah, American Smelting & Refining has built a power line to the Tintic Ophir properties, on Lion Hill. A gasoline engine and a small Sullivan compressor have been installed. Two headings, a drift and a raise, are being driven to the Humbug limestone.

The company has completed mapping and geologic reports of its holdings in the Park City district.

Frisco Crosscutting at 125 Ft.

Frisco Silver Lead, adjoining Horn Silver, near Frisco, Beaver County, Utah, is crosscutting a highly mineralized limestone, on the 125 level, to a main fissure. The railroad to Newhouse has been repaired so that hauling of machinery for the Imperial Copper mine may start. Two carloads of ore were recently shipped.

Cons. M. & S. Relinquishes Lois River Power Rights

J. J. WARREN, president of Consolidated Mining & Smelting, has withdrawn his company's application for power rights on the Lois River, about 50 miles to the north of Vancouver, B. C., and the rights have been granted to the Powell River Company, the largest manufacturer of pulp and paper in British Columbia. Mr. Warren said that his company sought the rights in connection with a copper smelter that it intended to erect at a point on the Pacific Coast. When he found that the rights were essential to the Powell River Company—which has a plant only 10 miles from the Lois River—his company decided to withdraw, however, as equally good power and smelter sites are available on other parts of the coast.

Young Discusses Litigation at Missouri School of Mines

THE Mining and Metallurgical Association of the Missouri School of Mines was addressed on Thursday, Oct. 24, by Dr. L. E. Young, vice-president of the Pittsburgh Coal Corporation and former director of the Missouri School of Mines. The subject was "The Actual Preparation of Engineering Data for Court Cases."

Dr. Young devoted the first part of his address to the procedure in preparing for mining litigation. The importance of a thorough understanding of the case, dependable and accurate data, and selection of able and honest witnesses were emphasized, and the part played by exhibits, as well as the method of presentation of the case, were discussed in detail. The last part of the address dealt with the application of the aforesaid principles to a particular case in which he was acting as an engineer. Dr. Young's address was followed by a brief discussion by Dr. H. A. Buehler, State Geologist of Missouri, in which Dr. Buehler re-emphasized the points brought out by Dr. Young and summed it up with a significant phrase—"know your stuff."

Build Two More Dredges for Fairbanks Exploration

Two new dredges to be used by Fairbanks Exploration, subsidiary of U. S. Smelting, Refining & Mining, in exploiting placer deposits near Fairbanks, Alaska, are now under construction and will be completed about Dec. 1. The company placed three dredges in operation last year, which was the first year of production, and added two more to the fleet this last summer.

Sulphide Corporation Increases Mill Capacity

THE capacity of the Sulphide Corporation concentrator at the Central mine. in the Broken Hill district, New South Wales, Australia, has been increased to about 1,000 tons daily from 500 tons. This increase was effected to permit treating ore from the Broken Hill Proprietary and Block 14 mines, which were reopened early in September. As the Central mine itself produces about 400 tons daily, the two other mines will probably increase production to furnish the remaining tonnage. Labor is scarce in the Broken Hill district, however, and some time will probably elapse before capacity is attained.

Before the Block 14 and Proprietary mines were closed, in 1927, because of low metal prices, ore from both properties was treated at the Proprietary mill. In the future this plant will be used only for crushing, however, as the coal supply is inadequate and expensive.

Late in September the first of two Diesel engines that will furnish power for Sulphide Corporation in the future was started. Considerable savings over power costs with coal as fuel are expected.

Treatment of material from the North Broken Hill dump has been completed, according to the secretary of the company, and production of concentrate from that source has ceased.

Boulder Perseverance Hits Ore on 1,600 Ft.

Diamond drilling on the 1,600 level of the Boulder Perseverance mine, at Kalgoorlie, Western Australia, struck gold ore north of the workings recently, according to an official announcement of the company. This ore is supposed to be a downward extension of the east boundary lode found on the 1,300 level. A crosscut has since been driven to the find on the 1,600 level, and high-grade ore has been found over a width of 11 ft. 4 in. More work will have to be done before conclusions as to its importance can be made, however.

Drop Mararoa Option

H. E. Vail, of Kalgoorlie, Western Australia, and associates have dropped the option they held on the Mararoa Gold property, at Reedy's, near Cue, Western Australia. This option, which was for eighteen months, was renewed on July 1 as a continuation of an existing agreement.

Park Kaiora Completes Camp

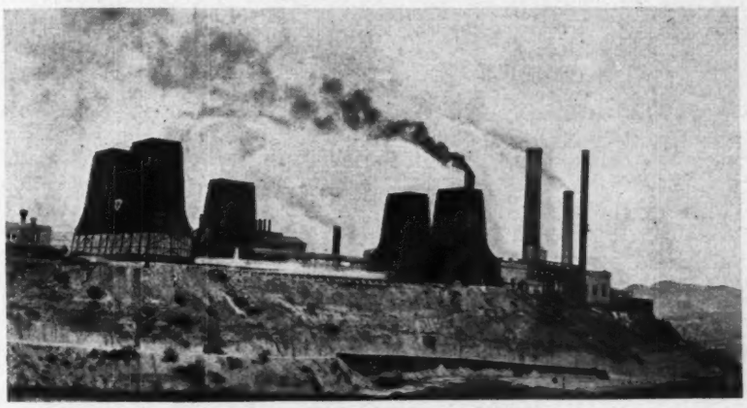
Camp buildings for winter operations have been completed at the Park Kaiora, in the East Park City district, Utah, adjoining the Valeo mine. The tunnel is being advanced along an east break to reach the Valeo fissure.

New Construction Work in Globe-Miami District Practically Completed

Miami Handling 18,000 Tons Daily Since September—Inspiration Operating Only Five Concentrator Units, But Leaching Plant Is at Capacity—Progress at Other Mines

A. J. McDermid
Special Miami Correspondent

COPPER mining continues at a prosperous pace in the Globe-Miami district of Arizona, and in the surrounding region, although some mines have curtailed output, in accordance with the 10 per cent cut anounced by the more important copper companies last spring. Inspiration Consolidated is operating its leaching plant at capacity, but only five or six of the twenty concentrator units are running. The Inspiration power plant, at the International smelter, has a new duplex natural-draft cooling tower in operation, as well as a new 1,218-hp. boiler.



Part of the new duplex cooling tower at the Inspiration power plant in the Globe-Miami district. The steel stack at the right is new. The new addition to the boiler plant is just left of the stack.

With these improvements, the power plant has been able to meet demands made on it by the Salt River Valley Water Users. This organization sells power to Inspiration and other mining companies when a surplus of water is available in the Roosevelt reservoir. At present the reservoir is nearly empty, and Inspiration is selling power from its own plant to the organization.

Construction of the plant for treating fines from the leaching plant is expected to be completed by January, 1930. It will treat about 500 tons of fines, carrying 90 per cent minus-200-mesh material. These fines are now being stored for future treatment. The plant will cost about $650,000.

At the Miami Copper mine, the major items of the construction program that has been under way for the last two years have been completed. The new boilers and the 11,500-hp. turbine are in operation and have eased the load on the other power plant units. In the concentrator, Williamson ball mills, Dorr bowl classifiers, and Miami-Dunn flotation machines have been added to each of the six units. The hoist at No. 5 shaft, through which the entire Miami tonnage is lifted, has had two motors geared to it since July, but has been hoisting between 17,000 and 18,000 tons daily only since September. This tonnage contrasts with 12,000 tons formerly. Miami tonnage was raised by the directors as a result of the satisfactory situation of the company's ore reserves.

Concentrator capacity at Old Dominion, the only other producer of importance in the Globe-Miami district, has recently been increased to 1,600 tons daily. The power plant is now working under a handicap, as it is hardly sufficient to handle the increased requirements. However, foundations for a new 2,250-hp. Nordberg Diesel engine are being laid. It will be added to the two Nordberg engines now in use. One of these drives a General Electric a.-c. 850-kva. 2,300-volt generator and the other a Westinghouse generator of the same size.

Old Dominion is understood to be adding to its ore reserves on the lower levels in the west side of the property. This material is said to be lower grade than the average Old Dominion ore, but it can be treated at a profit by using mining methods which have been adapted from those in use at Phelps Dodge's Morenci mine. H. A. Leidich, superintendent at Old Dominion, was formerly general foreman at Morenci.

Outside Globe-Miami proper, the Magma Copper property, at Superior, is preparing to carry out its $2,000,000 shaft-sinking program, which will aid in the development of the new orebody found southwest of the No. 5 shaft. Sinking of No. 7 shaft will soon be started and work on No. 6 shaft, which will be sunk to 2,250 ft., is progressing. The tunnel to No. 6 shaft is now being concreted. No. 2 shaft is being sunk to 3,250 ft. and concreted. When this is completed, No. 3 shaft will be sunk to a similar depth. Production from the property continues at the rate of about 3,300,000 lb. a month, and the total production for the year will probably fall just short of 40,000,000 lb.

At Ray, Nevada Consolidated has made no important changes in operation. This branch of the company did not curtail output last spring, as it was not increased in 1928, when other producers were stepping up their tonnage. About 10,000 tons of ore, averaging from 1.25 to 1.40 per cent copper, is being handled daily.

In the asbestos district, northeast of Globe, the mill and mine at Regal have been shut down for several months. The tungsten mill recently constructed at Globe will be used for experiments on vanadium ores of the district. The mill is owned by E. C. O'Brien & Company, which has purchased 120 tons of vanadium ore from George Wilson and Will Peters, of Globe. Several vanadium deposits have been found in the district, and, if the experiment proves satisfactory, production may be increased.

C. & A. Completes Installing New Hoist at Campbell Shaft

ASSEMBLING and installation of the new Allis-Chalmers electric hoist at the Campbell shaft of Calumet & Arizona Mining, at Bisbee, Ariz., is nearly completed. The current has been turned on and all the apparatus has been tested. The hoist will be able to operate to a depth of 3,600 ft. at a speed of 2,000 ft. per minute. It has a capacity of 5½ tons per trip. The Campbell shaft is being deepened from 2,200 to 2,500 ft. Ore from the new Campbell orebody will be handled through this unit, instead of through the Junction shaft.

The first steel headframe to be used by C. & A. in the district has been transferred from the Irish Mag shaft to the Saginaw shaft, which will be deepened, concreted, and used for ventilation purposes. Excavation for the new power house at the Junction shaft has been completed, and concrete is being poured in the foundation.

Monte Cristo Mine Sold to A. A. Krell

Sale of the Monte Cristo mine, near Wickenburg, Ariz., to A. A. Krell for $9,449 is reported. The sale was made to satisfy a judgment against the property. The Monte Cristo company can redeem the mine by paying the amount of the judgment, plus interest and costs within six months. This property was bought by C. C. Julian in 1926, for a price reported to be $1,000,000.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Dominion Explorers Ending Active Prospecting Season in Northern Canada

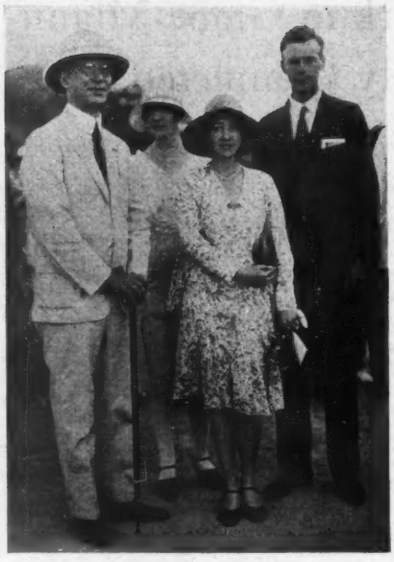
TORONTO, ONT., Oct. 26, 1929.—Although all the prospecting parties of Dominion Explorers have not yet returned, four discoveries have been reported this summer by this company which may prove to be important. Near Lake Athabasca, in Saskatchewan, a large surface showing of copper ore was uncovered. Two diamond drills have been sent to the site, and drilling is probably under way already. Other reported discoveries are a silver-lead deposit in the Laird River area, in northern British Columbia, and a gold discovery made in the Peel River country, in the Yukon Territory. Several claims with native-copper outcrops have also been staked in the Coppermine River district, Northwest Territory. In addition, preparations have been made for next year's work, and supply depots, containing gas, food, and mining supplies, have been established at several points, in the north and northwest.

THREE veins carrying copper ore have been found about 40 miles west of Lake Chibougamau, northeastern Quebec, by Prospectors Airways, Ltd. The find is near Lake Openiska. The first vein has been traced for 1,200 ft., the second for 750 ft., and the third for 350 ft. All have showings of massive chalcopyrite. The gold and silver content is said to be considerable. This discovery was made as a result of airplane scouting. According to the geological map, the rocks in the district are granite. In flying over the country a change of formation was noted, however. The discovery was made within a short time in a large area of Keewatin rocks. Ventures, which holds stock in Prospectors Airways, is expected to take an option on the claims.

Development work on the four new levels from 625 to 1,000 ft. at the Howey Gold mine, Red Lake, Ont., has shown a new oreshoot, expected to be of higher grade than the ore developed above the 500 level. Widths of 20 to 25 ft. are reported, for a length of 100 ft., with faces still in ore. Construction of the 500-ton mill is said to be two weeks ahead of schedule.

Mina Mercury Plant Increasing Output

Production from the Mina Mercury plant, near Mina, Nev., is now about two flasks of quicksilver daily, according to E. W. Bedford, superintendent. The plant was started on Oct. 3. A shipment of about 35 flasks was made the last week of October.



The Lindberghs arrive in bauxite land. Governor Rutgers at the left

Lindberghs Visit Guiana in an Aluminum Plane

RECENTLY, *E.&M.J.* published a series of articles on bauxite mining in the Guianas. At about the same time, Col. Charles Lindbergh was opening the new extension of the Pan-American Airways between San Juan, Porto Rico, and Paramaribo, Dutch Guiana. On this flight the famous flyer flew a plane, fabricated almost completely from strong aluminum alloys, back to the country from which the ore of aluminum comes. Possibly on no other epoch-making flight has the story of the strong alloys of aluminum, which mean so much to aviation, been as forcefully interwoven. Colonel Lindbergh, accompanied by Mrs. Lindbergh and Mr. and Mrs. J. T. Trippe, of the Pan-American Airways, landed on the Surinam River at Paramaribo just as the sun was setting on Sept. 23, 1929. The official welcoming took place that evening at a state dinner given by His Excellency Governor A. A. L. Rutgers.

The following day, Colonel and Mrs. Lindbergh and Mr. and Mrs. Trippe were entertained in the home of Mr. and Mrs. O. M. de Munnick. Mr. de Munnick is manager of Surinaamsche Bauxite Maatschappij, a subsidiary of the Aluminum Company of America and one of its principal bauxite mining enterprises.

Ship From Gold Strike Near Anyox

J. Flynn has uncovered a 1-ft. vein of rich gold quartz on the Elkhorn group, at Hastings Arm, near Anyox, B. C., for a distance of 150 ft. The gold is associated with galena, sphalerite, and pyrite. Mr. Flynn and his partners are making efforts to sack as much ore as possible before snow puts an end to the work until next season.

Mexico City Letter

BY W. L. VAIL

Special Correspondent

Labor Law Probably Not to Pass at Present Session of Mexican Congress

MEXICO CITY, Oct. 26, 1929.—The present session of the Mexican Congress, with only six weeks left, will probably not see the passage of the much-discussed labor law, in spite of earlier reports that it would go through. The incoming legislature is not expected to be quite as determined to pass the law as it stands. Both the employees and the employers are desirous of having legislation passed that will clearly define the rights and obligations of labor, but many of the business men feel that the proposed legislation does not give the obligations as much attention as the rights. Eventually, revision of the proposed code would be necessary, they maintain.

CLOSING of the Republic Mining & Metals antimony smelter, at Wadley, San Luis Potosi, is announced. This company is a subsidiary of Cookson & Company, of England. The reason given for closing the plant, which consists of two 50-ton furnaces, is that further operations in Mexico are not justified. A new smelter will be built at San Antonio, Tex., to treat Mexican ores. Few, if any, of the men now employed by the company will be left without work, however, as some are to be transferred to San Antonio, and others will be given jobs at various mines. A satisfactory arrangement has been made by the company with Mexican officials.

Application for permission to stop operations has been made by Dos Estrellas, at El Oro. This mine has been operating regularly, although in difficulties because of the low-grade ore handled. The low price of silver has undoubtedly added to the company's troubles.

Geological Report Halts Dam Construction

Experience in the efficacy of dam sites led to suspension of all work on the San Gabriel dam, in southern California, on Oct. 15, following a report by a board of engineers and geologists, consisting of L. C. Hill, R. T. Hill, C. F. Tolman, and A. J. Wiley. The project involves about $25,000,000, of which $3,000,000 had already been spent in excavation and railroad work. A further investigation will be made on the findings of the board to the effect that a dam of the proposed height could not be maintained safely on the available foundation. Fault and shear zones, as well as poor rock conditions, were found.

Technique of Industrial Sales and Advertising Research

MALCOLM MCGHIE
Industrial Marketing Counsellor,
McGraw-Hill Publishing Company, Chicago

THE matter about which I am going to speak today is the application of research and engineering principles to the problem of marketing a product. We don't often think of marketing as a problem in engineering, and yet there is a great deal of benefit in an engineering approach. I could not possibly give you a cure-all for your marketing difficulties; my job is merely to give you ideas. As you know, every merchandising problem is different. No "canned" selling plan can be good; you must make it yourself, tailored to fit your own specific requirements.

Dr. Julius Klein, as head of the Bureau of Foreign and Domestic Commerce, in a speech some months ago, quoted an analysis of income tax returns on a recent year. It was found that the average profit margin made by the companies reporting was surprisingly low. The banking industry, for example, showed the largest profit margin at 12.5 per cent. All other industries that reported showed profit margins of less than 8 per cent.

Granting that the objective of business is profit, it seems that the hard-boiled American still has something to learn about business.

Dr. Klein's organization then made an inquiry among a number of companies as to the reasons for this narrow profit margin; 91 per cent replied, "Intense competition." When asked what they were doing about it, 73 per cent replied that they were attempting to cut production costs, and only 29 per cent replied that they were attempting to reduce their distribution costs. Yet Mr. Hoover has said that the elimination of waste in distribution is one of our largest possibilities for increasing profits. He estimates this waste as 50 per cent greater than the entire export business of the country. Let me emphasize, therefore, that on the merchandising side of your business you have probably a large opportunity for increase of the net profit.

I propose now to show you briefly some of the engineering principles of developing a merchandising plan for the industrial market. The four principles of industrial marketing are: market determination; buying habits; channels of approach; and sales appeals. There are many ramifications in the industrial market. The eleven main buying divisions are: mining industries, public utility industries, public works, construction, process (or chemically controlled) industries, food industries, metal-refining industries, metal-working industries, textile industries, wood industries, and a group of miscellaneous industries which it is impossible to classify elsewhere. Each of these divisions in turn is made up of a number of individual industries and the industrial market is really a very complex host of different kinds of plants. Each industry has its own particular technology, its own particular equipment, and its own particular possibilities as a market. The more you study the buying structure of industry the more you see the necessity of making careful market investigation to find out how much of your product can be marketed to any particular field, and whether it will be profitable to you.

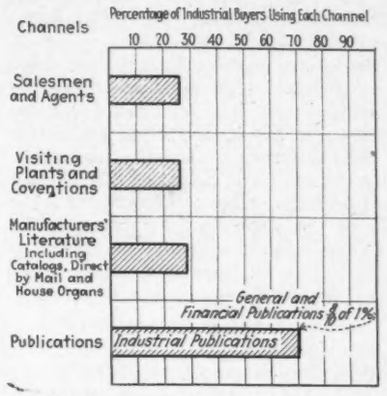

Channels
Percentage of Industrial Buyers Using Each Channel
10 20 30 40 50 60 70 80 90
Salesmen and Agents
Visiting Plants and Coventions
Manufacturers' Literature Including Catalogs, Direct by Mail and House Organs
General and Financial Publications ⅔ of 1%
Publications
Industrial Publications

Fig. 1—A key to the relative importance the buyer attaches to various types of information

There is probably a question in your minds how to select markets. Where will you get detailed information on which to judge and pick markets? First, there is one very important source which is often overlooked—your own records of past sales. These records of business are a mine of information about your markets, because the success or lack of success that you have had in selling your products to various fields is a good indication of the future possibilities. In some cases you can choose a market on the basis of available statistics. For instance, the government has statistics as to the amount of primary horse-power, the number of employees, annual production, and so forth. But on many occasions there are no available statistics which accurately measure sales possibilities and you have to go more deeply into the uses of the product in each market and base your answer on judgment only. And a third means of choosing a market is to put various experimental installations in the field, this of course, being a method frequently used.

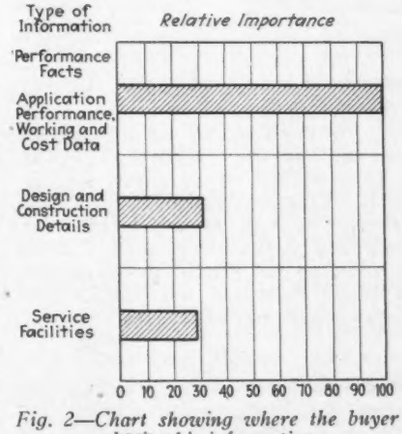

Type of Information
Relative Importance
Performance Facts
Application Performance, Working and Cost Data
Design and Construction Details
Service Facilities
0 10 20 30 40 50 60 70 80 90 100

Fig. 2—Chart showing where the buyer obtains his information

A main point, of course, in the selection of markets is that if you are doing it only by mathematics you are apt to be misled, because the revenue-producing power of most markets depends on a great many variables. A mathematical answer must always be corrected for special conditions of competition, geographical location, sectional prosperity, and so forth. After all, you are not only looking for the total revenue possible to secure from any market but you are looking for its net worth to you. In other words you are vitally concerned with the relation of its total value to the cost of getting the business. This is a matter of mathematics to the degree to which you have accurate information; beyond that, it is a matter of judgment.

So let me put the purpose of market analysis in a few words:

First, to direct selling and advertising at worthwhile markets, in full proportion to potential net profit.

Second, to improve the forecasting of sales (for budget purposes, production control, and quotas).

Third, to know markets more closely, with the idea of improving the product design, service facilities, and the technique of marketing.

We come now to sales promotion and advertising. Make use of the buyer's point of view in planning sales promotion, because, after all, the main purpose of advertising in the industrial field is to bring information to the buyer. If you simply high-pressure him in your advertising you are apt to fail. Give him the necessary information and let the salesman close the order.

Fig. 1 shows an investigation made by Ernst & Ernst, industrial accountants, to find out the various means by which the buyer gets information about equipment and methods. We, as publishers, were naturally glad to find in this unbiased survey the trade and industrial publications so widely relied upon.

In the same investigation, Ernst & Ernst found out what kind of information the buyer wanted, as a key to the kind of copy which he should be given. Fig. 2 shows that what he wants primarily is facts about performance. He is not interested in your plant, or a picture of your president, or how long you have been in business. He is selfish and is interested only in what the product will do for him.

Abstract from an address delivered before eleventh annual meeting, American Zinc Institute, Inc., St. Louis, Mo.

MARKET AND FINANCIAL NEWS

London Financial News

W. A. Doman
Special London Correspondent

London, Oct. 15, 1929—Tin producers are becoming nervous again. The price of the metal has fallen to under £190 a ton, and the confident predictions indulged in earlier in the year, that £250 would be reached before Christmas, are apparently not to be materialized. In fact, in some circles, a certain amount of anxiety is apparent. Tin has been carried at what appears now to be a high price, and America, the largest consumer, shows no disposition to come forward to relieve matters. The opinion had been held that a merger of prominent producers would strengthen the position. No merger has been effected, and those interested in the industry are asking what the next step is to be. As all along, two views are held, and one is that the present price of tin is the result of bear operations. But at this level many companies can do little more than meet working expenses. And yet as regards Malayan producers there are big purchasing orders in the market, and shares that are being jettisoned by nervous holders are finding a good home. One broker has within the last few days bought between 200,000 and 300,000 shares in the best companies. This does not indicate panic; rather is it the sign of a belief in recovery. For a time dividends are likely to be lower, and Cornwall at least cannot be carried much longer. One reason given for the low price of tin is the increasing use of cardboard cartons. Also, there is talk of a new copper alloy discovery by Vickers-Armstrong at Barrow. It is displacing tin as a hardener for copper in engineering alloys such as brasses and bronzes, and it is said that it may replace the 10 per cent of tin normally used in some kinds of brass.

Lead seems to be fairly well stabilized, and no one takes much notice of this metal, seeing that hitherto only a couple of firms are interested in its marketing—the British Metal Corporation and Henry Gar ner & Company. Within the last few days a scheme has been put forward fo the fusion of these two undertakings so that in the near future even less interest in the matter will probably be manifested. Shareholders in the former are not quite satisfied with the terms of the fusion, as they consider that Gardner shareholders are being treated too generously. The B. M. C. has an authorized capital of £5,000,000, of which £1,800,000 is in issue, equally divided between 6 per cent preference and ordinary shares. Henry Gardner's authorized capital is £1,000,000. B. M. C. preference holders are to receive similar shares in the holding company; holders of ordinary shares are offered 200 holding shares for every 100 shares. Holders of Henry Gardner ordinary are offered 160 holdings for every 100 shares now held.

Rhodesian copper shares have been quiet of late. However, now that Sir Edmund Davis has returned from his holiday and Sir Ernest Oppenheimer is in this country, a "certain liveliness" is looked for. The policy of discounting the future is to be continued. As the bulk of the shares are supposed to be in strong American hands, no one seems to worry, as all hope to pocket profits before the production stage is reached.

Howe Sound Net Income in Third Quarter $940,034

Howe Sound Company, operating in British Columbia and Mexico, reports for the quarter ended Sept. 30, 1929, a net income of $940,034 after payment of taxes, depreciation, and other charges, but before depletion. This compares with $1,028,682 in the preceding quarter and $668,194 in the September quarter of last year. Profit for the nine months ended Sept. 30 totaled $2,959,001, before depletion, against $1,894,554 in the corresponding period last year.

Income account for the first nine months of 1929 and 1928 follows:

	1929	1928
Gross	$12,958,511	$11,220,639
Operating costs	9,623,780	8,944,336
Operating income	$3,334,731	$2,276,303
Other income	364,331	290,446
Total income	$2,699,062	$2,566,749
Depreciation	740,061	672,195
(a) Profit	$2,959,001	$1,894,554

(a) Before depletion.

In the third quarter of the current year the company produced 3,541 oz. of gold, 837,002 oz. of silver, 10,722,368 lb. of copper, 19,656,418 lb. of lead, and 12,905,413 lb. of zinc. This compared with 3,683 oz. of gold, 723,673 oz. of silver, 10,904,510 lb. of copper, 19,610,555 lb. of lead, and 15,322,915 lb. of zinc in the second quarter.

Quincy Mining Company has called a special meeting of stockholders for Nov. 22 to act on the proposal of the directors to increase the outstanding stock of the company from 200,000 shares of $25 par value stock to 230,000 shares by offering the additional 30,000 to stockholders at $25 a share, in the ratio of three new shares for each twenty shares held.

World Lead Production Down in September

Lead production of the world in September was 158,446 tons, against 161,207 tons in August and 148,512 tons in September of last year, according to the American Bureau of Metal Statistics. Though actual production for September showed a decline from that of the month previous, the daily rate was slightly higher, being 5,282 tons, against 5,200 tons in August. The daily rate of production for the first nine months of the current year was 5,263 tons, which compares with 4,976, the daily rate for the whole of last year.

World output of lead for the first nine months of the year totaled 1,436,925 tons, a monthly average of 159,658 tons. The revised total output for the whole of 1928 is 1,821,080 tons, a monthly average of 151,757 tons.

Production, by countries, for July, August, and September, follows:

	July	August	Sept.
United States (a)	56,924	53,316	56,879
Canada (a)	14,279	15,755	13,962
Mexico (a)	26,654	23,164	20,569
Total North Am. (a)	97,857	92,235	91,410
Peru	2,122	2,250	1,586
Germany	8,988	10,509	11,881
Italy	2,100	2,283	1,625
Poland (c)	2,970	3,465	3,387
Spain and Tunis (b)	8,392	9,992	8,035
Australia	16,683	16,075	16,128
Burma	7,392	7,398	7,394
Rhodesia	90	.....	.....
Elsewhere (d)	17,000	17,000	17,000
World's total	163,594	161,207	158,446

(a) Total North American production of crude lead is correctly stated, but the distribution by countries is not precise. (b) Partial. (c) Represents production previously entered under the head of "Polish Silesia." (d) Estimated

Butte Copper & Zinc Earnings Show Gain

Butte Copper & Zinc Company reports for the nine months ended Sept. 30, 1929, net income of $162,906 after expenses, taxes, and other charges equivalent to 27c. a share on 600,000 shares of stock. This compares with $132,108, or 22c. a share, in the first nine months of 1928.

Net income for the September quarter was $64,802, against $53,364 in the preceding quarter.

In the three months ended Sept. 30, 1929, the company mined 41,591 tons of ore, making 123,345 tons in the first nine months.

Quicksilver Imports Into the United Kingdom in September were 1,777 flasks, against 7,940 flasks in the same month last year. Imports for the first nine months of the year totaled 3,813 flasks against 21,955 flasks in 1928.

Chosen Corporation Net for Year £10,113

CHOSEN Corporation, Ltd., operating the Great Nurupi mine, in Korea, reports a net profit for the year ended June 30, 1929, of £10,113, after deductions for London expenditures, loss on exchange, income tax and other charges. During the fiscal year the Nurupi mine milled 93,751 tons of ore and recovered bullion valued at £125,072. This compares with 94,061 tons milled in the preceding year, valued at £124,318. As a result of the embargo against export of gold from the Japanese Empire, production could not be sold at the standard price.

Texas Gulf Sulphur Reports Higher Earnings

TEXAS Gulf Sulphur Company, Inc., reports for the quarter ended Sept. 30, 1929, net income of $4,028,959 after depreciation and federal taxes, but before depletion, equivalent to $1.58 a share on 2,540,000 shares of no-par stock. This compares with $3,680,723, or $1.45 a share, in the third quarter of 1928.

Net income for the nine months ended Sept. 30 totaled $11,480,489, comparing with $10,355,381 in similar period last year. During the last quarter the company increased its reserves for depreciation and accrued federal taxes by $567,194, making total of these reserves $12,389,090.

International Corporation Formed to Develop Mines

AMERICAN and Canadian interests have joined in the formation of the International Mining Corporation, a $10,000,000 concern organized under the laws of Delaware to develop mining properties in various parts of the world. H. W. Chadbourne, New York, is president, and the vice-presidents are K. F. Hoffmann, W. B. Baggaley, and George A. Easley. Other directors are J. C. Brennon, Thomas L. Chadbourne, Arthur W. Cutten, James H. Douglas, Sir Charles Gordon, Harry G. Haskell, Sir Herbert S. Holt, James Y. Murdoch, Percy Rockefeller, Silas Strawn, S. C. Thomson, and Archer E. Wheeler.

Announcement of the formation of the Delaware corporation followed closely upon organization of a similar company in Toronto. The Canadian company, according to reports, has an authorized capitalization of $40,000,000.

Dome Mines Earnings for Nine Months Increase

DOME MINES, LTD., operating in Ontario, reports for the nine months ended Sept. 30, 1929, net earnings of $1,673,649 after expenses and federal taxes, but before depreciation and depletion, comparing with $1,334,528 in the first nine months of 1928.

Net earnings for the quarter ended Sept. 30, totaled $464,764 before depreciation and depletion, against $655,486 in the preceding quarter and $465,321 in the third quarter of the previous year.

Income account for the nine months of this year and 1928 follows:

	1929	1928
Gross income	$3,114,454	$2,804,001
Expenses	1,600,970	1,575,888
Federal taxes	80,137	62,644
Operating profit	$1,433,347	$1,165,469
Other income	240,302	169,059
(a) Total income	$1,673,649	$1,334,528

(a) Before depreciation and depletion.

FURUKAWA MINING, operating in Japan, produced 1,425 short tons of copper in August, bringing the total for the first eight months of the current year to 11,785 tons.

Imports and Exports of Ores and Metals in September, 1928 and 1929

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

Imports

	September 1928	September 1929
Antimony		
Ore, gross weight	765,110	452,300
Ore, antimony content	394,669	180,960
Copper		
Ores, copper content	7,418,098	16,067,028
Concentrates, copper content	3,017,100	5,009,432
Regulus, coarse metal, cement copper	133,390	15,414
Imported from:		
Spain	639,587	3,558,401
Canada	3,379,380	3,753,084
Mexico	2,431,047	2,488,462
Cuba	767,400	1,277,593
Chile	1,998,270	7,770,567
Peru	75,188	109,674
Other countries	1,277,716	2,134,093
Unrefined converter copper in pigs, bars and other forms	47,324,637	51,201,034
Refined copper	7,145,696	6,730,318
Old and clippings	758,771	1,148,472
Composition metal	21,411	.....
Brass, old, for remanufacture	1,434,070	932,077
Lead		
Ore and matte, lead content	3,832,198	10,496,577
Bullion or base bullion	18,598,910	6,532,603
Pigs and bars, old and scrap, lead content	.....	2,730
Type metal, antimonial lead, lead content	146,200	.....
Type metal, antimonial lead, gross weight	114,352	.....
Manganese, tons		
Cuba, manganese content	56	.....
Other countries, manganese content	12,576	13,123
Pyrites, tons	26,177	68,784
Tin, ore, tons	10	4
Bars, blocks, pigs	18,417,683	17,274,406
Imported from:		
Netherlands	437,249	1,794,230
United Kingdom	4,088,764	2,958,896
British Malaya	13,479,203	12,104,318
Netherland East Indies	116,650	.....
Hongkong	.....	291,662
Australia	60,480	120,800
Other countries	235,337	4,500
Zinc		
Ore, zinc content, free	.....	.....
Ore, zinc content, dutiable	244,087	184,700
Blocks, pigs and other forms, old	.....	.....

Exports

	September 1928	September 1929
Copper		
Ores, composition, concentrates, unrefined	94,612	253,359
Refined copper in ingots and other forms	61,974,905	73,107,268
Exported to:		
Belgium	2,490,265	3,108,329
France	9,515,776	18,950,542
Germany	11,003,213	12,350,493
Italy	11,406,772	7,374,352
Netherlands	2,024,012	2,914,303
Spain	256,753	258,124
Sweden	2,511,363	2,968,762
United Kingdom	11,965,271	15,084,872
Other Europe	783,904	3,868,607
Canada	1,522,723	2,677,239
British India	.....	2,953,367
China, Hongkong, Kwantung	4,490	7,041
Japan	8,380,605	.....
Other countries	109,758	591,237
Old and scrap	3,901,934	2,733,161
Pipes and tubes	380,733	267,372
Plates and sheets	462,515	376,758
Rods	5,219,374	7,684,422
Insulated copper wire and cables	1,805,821	1,818,297
Lead		
In pigs, bars, and other forms	.....	.....
From foreign ore	19,787,802	11,190,539
From domestic ore	1,584,124	3,167,638
Exported to:		
Belgium	1,232,608	.....
France	336,111	751,107
Germany	3,365,453	560,163
Netherlands	2,028,000	224,145
Sweden	392,104	560,292
United Kingdom	8,066,604	7,402,395
Other Europe	729,018	739,451
Brazil	526,451	224,253
Other South America	62,071	36,439
China, Hongkong, Kwantung	280,100	.....
Japan	4,145,430	3,529,370
Other countries	207,976	330,562
Other lead manufactures	1,133,067	656,637
Zinc		
Ores and concentrates, tons	.....	.....
Dross	253,255	422,05
Cast in slabs, blocks, and pigs	2,911,321	736,61 3
Exported to:		
Belgium	.....	22,379
France	448,045	.....
Germany	336,041	30,000
United Kingdom	8,515	672,316
Other Europe	191,353	.....
Japan	1,792,117	.....
Other countries	135,250	11,918
Sheets, strips and other forms	691,601	2,904,538
Dust	119,934	467,645
Other zinc manufactures	51,121	269,16

The Market Report

Wall Street Crash Has Little Effect on Metal Markets

New York, Oct. 30, 1929.—The phenomenal drop in the share market, which set in last Thursday and continued through yesterday, has made the metal markets, already dull, even quieter, but has not resulted in any precipitate drop in metal prices. To be sure, lead, zinc, tin, silver, and quicksilver are slightly lower than they were a week ago today, but the decline in each instance has been very small, and in the case of lead and zinc has been brought about by weakness abroad bringing the London price below import parity. Copper stands firm. Metal producers are not expecting to do much business until the flurry in Wall Street has subsided. They consider that consumptive demand in most industries will not be seriously curtailed during the winter and with no burdensome stocks on hand, they feel reasonably secure, with the threat of further declines abroad the most serious factor in the situation. Metal buying, in general, is for prompt shipment, which adds to the fundamental soundness of the situation.

Daily Prices of Metals

Oct.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
24	17.775	41.875	6.90	6.70	6.70
25	17.775	41.375	6.90	6.70	6.70
26	17.775	41.25	6.90	6.70	6.70
28	17.775	40.875	6.90	6.70	6.60
29	17.775	40.75	6.75	6.55	6.50@6.60
30	17.775	41.25	6.75	6.50@6.55	6.60
	17.775	41.229	6.850	6.646	6.642

Average prices for calendar week ending Oct. 26, 1929, are: Copper, 17.775c.; Straits tin, 41.333c.; New York lead, 6.900c.; St. Louis lead, 6.700c.; zinc, 6.700c.; and silver, 49.958c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East are 1@1½c., depending upon purity, above St. Louis prices for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
24	72⅜	72¾	83¾	188¾	192⅞	23 9/16	23½	22½	22 15/16
25	72 1/16	72 7/16	83¾	186¾	190¾	23⅝	23 7/16	22⅝	23
28	72⅛	72⅛	83½	183½	187½	23⅜	23¼	22⅛	22½
29	71¼	71¼	83½	184¼	188¼	22⅞	22¾	22	22⅜
30	70 5/16	70 5/16	83½	184¼	187½	22⅜	22¼	22 1/16	22 7/16

Prices for lead and zinc are the official closing prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
24	$4.87 5/16	50	23	84s 11½d	28	$4.87⅜	49⅞	22 15/16	84s 11½d
25	4.87⅜	50⅛	23⅛	84s 11½d	29	4.87¼	49¼	22 13/16	84s 11⅝d
26	4.87¼	50	23	.....	30	4.87	49⅞	22⅞	84s 11⅜d

Average: Silver, 49.958c.; Sterling Exchange, $4.8726

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command seven-eighths cent premium.

Copper Quiet But Firm

Copper business again declined a little, for the fourth successive week, but transactions have not been of material volume since the early September rush, and it is idle to compare one week with another. Consumers report that manufactured lines have been hard to sell in the last few days, as the entire population of the country has riveted its attention on the stock market. They have had, therefore, no reason to buy more copper, as their immediate manufacturing needs have already been provided for. November, however, should see a larger tonnage sold than has October, both here and abroad. Some industries, such as the motor car and radio, will probably be slowed up by the stock-market debacle, and the demand for copper may be affected to some extent in other outlets in some of which cheaper metals can be substituted, but production can no doubt be adjusted to accord with any temporary softening in demand. Electrification projects should proceed as planned, assuring a continuance of the present high activity of the wire manufacturers.

Prices are entirely unaffected by the liquidation in the share market, business being sufficient to prevent any distress selling. The quotations continue at 18c. delivered in the East, and 18⅛c. in the Middle West, with Copper Exporters, Inc., selling at 18.30c. in Europe, in spite of a small tonnage of resale copper offered at 2½- to 5-point concessions abroad. The export market in October has reverted to the quietness that characterized it last spring.

Lead Down 15 Points

American Smelting & Refining lowered its contract price of lead on Oct. 29 to the basis of 6.75c., New York, a decline of 15 points from the previous quotation. St. Louis registered a similar decline, establishing the price in that territory at 6.50@6.55c. The chief cause of the drop in the quotation was the decline in London, where the metal sold off to a point slightly below the import parity. Weakness abroad, on the other hand, was ascribed to speculative selling inspired by the drop in securities in Wall Street.

Sales of lead in the domestic market were even smaller in volume than last week, though recent buying indicates that consumers are not at all covered for the November-December position. The decline in the price of lead failed to stimulate buying interest, and pro-

ducers believe that hand-to-mouth trading will continue until conditions in the financial world become more settled. Actual consumption of lead is going ahead at a good rate, the shipments for October being estimated at about 64,000 tons. With the exception of the automotive industry, the consuming industries that play an important part in the lead market are operating at a satisfactory rate. Reports from Europe, however, have been less encouraging, which has been reflected in the movement of prices in London.

Zinc Down to 6.60c.

Further declines abroad have forced domestic smelters to cut zinc quotations to 6.60c., St. Louis, though ore prices are unchanged in the Tri-State market. In fact, competition Monday and Tuesday caused even lower prices to be quoted, though the slight advance in London today seems to have been sufficient to bring all first hands back up to a firm 6.60c. basis. Sales have been very satisfactory, though but little publicity has been given to them. Immediate shipment has been chiefly in demand.

Tin Unsettled

Early in the week prices for tin held on a fairly steady basis. For a time it looked as if the disturbance in Wall Street would have little influence upon the market, one reason advanced for this condition being that prices for tin already had reached a low point and therefore were less vulnerable to raids by the bear element. But subsequent dullness unsettled the market to the extent that prices here suffered a net decline for the period of about ¾c. per pound. At the lower level both buyers and sellers were inclined to hold off, awaiting further developments in financial quarters.

Foreign Exchanges Active

Foreign currencies in general have been active, with an upward tendency in the New York market, though Canadian exchange reached the low point in several years, owing to liquidation of stocks. Closing cable quotations on Tuesday, Oct. 29, follow: Francs, 3.94⅛c.; lire, 5.23⅛c.; and marks, 23.94c. Canadian dollars, 2⅛ per cent discount.

Silver Quiet and Unchanged

The silver market has continued quiet and prices remained at about the same level as during the previous week. Reports from abroad state that India has been an occasional buyer and that China operated both ways.

Mexican Dollars (old Mexican pesos): Oct. 24th, 37⅛c.; 25th, 37¼c.; 26th, 37⅛c.; 28th, 29th, and 30th, 37c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 8¾c. per lb. for spot and future shipments. Prices have been raised ⅛c. on steadiness in China, following higher transportation charges. Demand has fallen off at the advance. Cookson's "C" grade, spot, 14c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.80 and up.

CADMIUM — Per lb., New York: 80@90c. Active demand.

IRIDIUM — Per oz., $220@$230 for 98@99 per cent sponge and powder.

NICKEL — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $35@$37. Small lots bring up to $46.

PLATINUM — Official price quoted by the leading interest on small orders for refined metal is $65 per oz. Transactions between dealers and refineries in the outside market are reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $123.50@$124. Trading continues quiet and prices on round lots more or less nominal. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of Oct. 5.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $15.25@$15.50 for future shipment. European consumers have been good buyers; demand here quiet. Prices steady on moderate offerings. Bolivian scheelite, $15.50@$15.75, Nov.-Dec. shipment. Western scheelite, $16.50 for Jan. shipment.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Oct. 5 issue.

Platteville, Wis., Oct. 26, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.75
Lead Concentrate	
Lead, basis 80 per cent	$87.50

Shipments for the week: Blende, 602 tons; lead, 40 tons. Shipments for the year: Blende, 27,937; lead, 1,700 tons. Shipments for the week to separating plants, 1,174 tons blende.

Tri-State Concentrate Steady

Joplin, Mo., Oct. 26, 1929

Blende		Per Ton
High		$46.85
Premium blende, basis 60%		44.00
Prime Western, basis 60%	$43.00@	44.00
Table concentrate, 60%	42.00@	43.00
Flotation concentrate, 60%	40.00@	41.00
Average settling price		43.69
Galena		
High		$89.00
Basis 80% lead		87.50
Average settling price		87.48

Shipments for the week: Blende, 12,313 tons; lead, 2,330 tons. Value, all ores the week, $751,900.

Sellers of all grades of zinc ore held firm. The producers of flotation concentrate, who have been endeavoring to advance the price from the present basis of $41 to a price level they deem more in accord with the quality of the product now being made, are still asking $42.50. However, hope of succeeding in an adjustment of a basis price advance for flotation zinc concentrate will doubtless be abandoned, in view of the fact that the London market for slab zinc developed a tail spin, following a report that the European zinc cartel was not functioning to the satisfaction of traders.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Oct. 5 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market less active, but prices generally firm.

SODIUM NITRATE — Per 100 lb., $2.10 for prompt delivery.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Oct. 5 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $34 f.o.b. furnace on carload business.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.45@$1.50, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the Oct. 5 issue.

Rolled Metals

Copper, lead, zinc, Monel metal, and nickel sheets, and copper wire are unchanged from prices in the Oct. 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Oct. 5.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces: Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL — Base prices per gross ton, Pittsburgh, billets and slabs, $35; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE — Per gross ton, Connellsville furnace, $2.65@$2.75. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis), $6.50; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended October 26, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda Copper	New York	110	92	102⅛	Oc. 11 No. 18 Q	1.75
Andes Copper	New York	49½	42	44⅛	Oc. 11 No. 11 Q	0.75
Arizona Com	Boston	1½	1½	1½	Jl. 16 Jl. 31 SA	0.25
Calumet & Ariz	New York	120⅛	105	112½	Se. 6 Se. 23 Q	2.50
Calumet & Hecla	New York	40	28	37⅛	Au. 31 Se. 30 Q	1.00
Cerro de Pasco	New York	89	80	82½	Oc. 10 No. 1 Q	1.50
Con. Coppermines	N. Y. Curb	9	6¼	7⅛		
Copper Range	Boston	21⅞	17	20	Se. 14 Oc. 15 Q	0.50
East Butte	Boston	1¼	1⅛	1⅛	Dec., 1919	0.50
Granby Con	New York	80	60½	72	Oc. 18 No. 1 Q	2.00
Greene Cananea	New York	165	165	165	Se. 12 Oc. 7 Q	2.00
Howe Sound	New York	58½	50	50⅛	Se. 30 Oc. 15 Q	1.00
Hudson Bay	N. Y. Curb	16¼	14⅞	16		
Inspiration	New York	39⅞	22	26⅛	Se. 9 Oc. 7 Q	1.00
Isle Royale	Boston	20⅜	18	18⅛	Au. 31., Se. 30	0.50
Kennecott	New York	79½	67	77	Au. 30, Oc. 1 Q	1.25
Magma Copper	New York	68½	61	67½	Se. 30, Oc. 15 Q	1.25
Mason Valley	N. Y. Curb	2	2	2		
Miami Copper	New York.	40¾	35	37⅜	No. 1, No. 15 Q	1.00
Mohawk	Boston	62	56½	58	Oc. 3, De. 2	3.00
Mother Lode	New York	2½	1½	2	Je. 13, Je. 29	0.20
Nevada Con	New York	44½	30½	40	Se. 18, Se. 30 Q	0.75
Noranda	N. Y. Curb	48	41⅛	43⅜		
Ohio Copper	N. Y. Curb	1¼	*50	1⅛	Sept., 1926	0.03
Old Dominion	Boston	8½	7	8	Dec., 1918	1.00
Phelphs Dodge	New York	58⅛	53	56	Se. 4, Oc. 1 Q	0.75
Quincy	Boston	43	38	38⅛	March, 1920	1.00
Roan Antelope	N. Y. Curb	40½	37	39		
St. Mary's M. L.	Boston	36	29	32	Fe. 25, Mr. 12	2.00
Seneca Copper	New York	4⅛	3	4		
Shattuck Denn	N. Y. Crb	13⅜	10⅛	11		
Sheritt-Gordon	Toronto	5.80	5.05	5.45		
Tenn. C. & C.	New York	17	14⅛	15	Au. 31, Se. 16 Q	0.25
United Verde Ex.	N. Y. Curb	14½	13	13½	Oc. 2, No. 1 Q	1.00
Utah Copper	New York			3.25	Se. 18, Se. 30 Q	4.00
Waite-Ack.-Mont.	Toronto	4.50	4.00	4.00		
Walker Mining	Salt Lake	6.00	5.50	5.55		
Wenden Copper	N. Y. Curb	*87½	*56½	*75		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	1⅛	1	1⅛		
Amer. Z. L. & S.	New York	19	10⅜	14½	May, 1917	1.00
A. Z. L. & S., pfd.	New York	91½	79½	80⅛	Se. 19, Oc. 1 Q	1.50
Bunker Hill & S.	N. Y. Curb	125	120	120	Se. 27, Oc. 5 MX	0.75
Butte Cop. & Zn.	New York	4	3	3½		
Butte Cop. Con	Boston Curb			*31½		
Butte & Sup	New York	7	6	6⅜	Je. 14, Je. 29 Q	0.50
Callahan Zn-Ld	New York	1½	1½	1½	Dec., 1920	0.50
Chief Consol	Salt Lake	2.70	2.60	2.70	Fe. 1, 1918 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	10½	8⅛	8⅛	Se. 20, Oc. 1 Q	0.25
Constitution	Spokane	*43	*40	*42		
Dayrock	Spokane	3.00	2.75	3.00	Je. 20, Je. 30	0.03
Dickens Consol	Spokane	*8⅛	*7	*7		
Eagle-Picher	Cincinnati	17	15½	15⅛	Se. 30, Oc. 15 Q	0.20
Eagle-Pich., pfd	Cincinnati	101	101	101	Se. 30, Oc. 15 Q	1.50
Erupcion	Boston Curb			*12	Jan. 1, 1928	0.07½
Eureak Bullion	Salt Lake	*82	*75	*77		
Evans-Wallower	N. Y. Curb	15⅛	9⅛	12⅛		
Evans-Wal., pfd.	N. Y. Curb			80	Je. 20, Jl. 1 Q	1.75
Federal M. & S.	New York			2.20	June, 1927	10.00
Fed. M. & S., pfd.	New York	97½	97	97	Au. 23, Se. 16 Q	1.75
Gladstone	Spokane	*3⅜	*3⅛	*3⅛		
Golconda	Spokane	*90	*80	*80	Je. 15, Jl. 1	0.02
Grandview	Spokane	*26	*20	*20		
Hecla Mining	N. Y. Curb	16½	15	16½	Au. 15, Se. 15 Q	0.25
Highland-Surprise	Spokane	*12	*11	*11		
Jack Waite	Spokane	*13⅜	*12⅜	*12⅜		
Kootenay Florence	Spokane	*9½	*7	*9½		
Lucky Jim	Spokane	*10	*8½	*8⅜		
Lucky Tiger-C.	Kansas City	†2.50	†2.25		Oc. 10, Oc. 20 M	0.02½
Mexican Premier	Spokane	2.15	2.14	2.14		
National Lead	New York	193	170	171	Se. 13, Se. 30 Q	1.25
Natl. Lead, pfd. A	New York	141	139½	141	Nv. 29, De. 14 Q	1.75
Natl. Lead, pfd. B	New York	118	118	118	Oc. 18, No. 1 Q	1.50
N. J. Zinc, new	N. Y. Curb	78⅜	75	78	Oc. 21, No. 9 Q	0.50
New Quincy	Salt Lake	1.75	1.60	1.60	Se. 20, Se. 30 Q	0.10
Noble Five	Spokane	*45	*32	*32		
North Lily	Salt Lake	4.82½	4.35	4.65	Oc. 16, Oc. 23	0.25
Park Bingham	Salt Lake	8⅛	8⅛	8⅛		
Park City Con	Salt Lake	1.50	1.25	1.25		
Park Utah	New York	5⅛	4	4⅛	Dividends suspended	
Pend Oreille	Spokane	3.60	2.50	2.50		
Rico Argentine	Salt Lake	*23	*23	*23	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	*26	*22	*23		
St. Joseph Lead	New York	76½	59	65⅜	Se. 10, Se. 20 QX	0.75
Sherman Lead	Spokane	*89	*75	*78		
Silver King Coa	Salt Lake			12⅜	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*7	*6¼	*6¼	Oct., 1926	0.02
Sunshine Mining	Spokane	6.85	6.10	6.30	Se. 10, Se. 20 Q	0.05
Tamarack-Custer	Spokane	*66	*58	*59	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.12½	12.00	12.00	Se. 17, Se. 20 X	0.30
Tonopah Belmont	N. Y. Curb	*50	*50	*50	Oct., 1925	0.05
Treadwell-Yukon	Toronto	8.00	7.75	8.00		
United Zinc Smg, New	N. Y. Curb	7¼	7¼	7¼		
Utah Apex	Boston	4⅛	3⅛	3⅛	Oc. 15, No. 1	0.25
Utah Met. & Tun	Boston	*85	*75	*80	Dec., 1927	0.30
Whitewater	Spokane	*35	*25	*25		
Yellow Pine	Los Angeles			*8	Dec., 1925	0.04
GOLD						
Alaska Juneau	New York	7⅛	6	6⅛		
Barry-Hollinger	Toronto	*21	*18	*20		
Central Manitoba	Toronto	*30	*20	*29		
Cresson Consol	N. Y. Curb	*50	*37½	*50	Se. 30, Oc. 10 Q	0.02
Dome Mines	New York	8⅜	8	8⅛	Se. 30, Oc. 21 Q	0.25
Golden Cycle	Col. Springs	1.67½	†1.62½		Au. 31, Se. 10 Q	0.04
Hollinger	Toronto	5.60	5.25	5.40	Oc. 18, No. 4 FW	0.05
Homestake	New York	84	83½	84	Oc. 19, Oc. 25 M	0.50
Kirkland Lake	Toronto	*68	*60	*60		
Lake Shore	Toronto	22.35	19.90	20.75	Se. 17, QX	0.42
McIntyre Porcupine	New York	14	14	14	Nv. 1, De. 2 Q	0.25
Portland	Col. Springs	†*8	†*6⅛		April, 1927	0.01
Rand Mines	New York	30	30	30	Au. 21, 29 A.s.	1.50
Siscoe	Toronto	*74	*66	*67		
Sylvanite	Toronto	*73	*55	*55		
Teck-Hughes	Toronto	6.00	5.35	5.65	Oc. 18, No. 1	0.15
Tom Reed	Los Angeles	*65	*60	*60	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	*68⅛	*87⅛		
Vipond Consol	Toronto	*73	*58	*67	April, 1927	0.03
Wright-Hargreaves	Toronto	1.50	1.40	1.50	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb			35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	14⅛	10⅛	13		
Castle-Trethewey	Toronto	*31	*29	*30		
Consol. Cortez	N. Y. Curb	*12½	*6½	*6½		
Dolores Esperanza	N. Y. Curb	*43⅛	*6½	*25	July, 1923	0.05
Keeley	Toronto	*44	*40	*40	Mr. 15, 1928	0.04
Mining Corp	Toronto	3.90	3.55	3.55	My. 30, Je. 13	0.12½
Montana-Mines Corp.	Spokane	*49½	*42	*42		
N. Y. & Hond. Ros.	N. Y. Curb			15½	Oc. 16, Oc. 26 QX	0.50
Nipissing	N. Y. Curb	2⅛	2	2	Se. 26, Oc. 21 Q	0.07½
Premier Gold	N. Y. Curb	1¼	1⅛	1⅛	Se. 12, Oc. 3 Q	0.06
Tonopah Exten.	N. Y. Curb			*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	2⅛	2⅛	2⅛	Se. 30, Oc. 21	0.07½
United Eastern	N. Y. Curb			*25		
Yukon Gold	N. Y. Curb	68⅛	*56½	*56½	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	112⅜	92½	103½	Jan. 18, Fe. 15 Q	1.50
Beth. Steel, pfd, 7%.	New York	126⅛	125⅛	125⅛	De. 7, Ja. 2 Q	1.75
Cleveland-Cliffs	Cleveland	98	96	97	Se. 5, Se. 15 Q	1.00
Colo. Fuel & Iron	New York	58½	39	48⅛		
Colo. F. & I., 1st pfd.	New York	126½	126½	126½	No. 10, No. 26 Q	2.00
Great Northern Iron.	New York	29	19	26½	Dec. 15 K	2.00
Inland Steel	New York	96	91½	91½	Au. 15, Se. 1 Q	1.87½
Republic I. & S.	New York	115	90	97½	No. 12, De. 2 Q	1.00
Republic I. & S. pfd.	New York	111	110½	111	De. 12, Ja. 2 Q	1.75
Sloss-Sheffield S. & I.	New York	50	48	48	Mr. 11, Mr. 20 Q	1.50
Sloss-Sheff. S.&I., pfd.	New York	69	68	69	Se. 20, Oc. 1 Q	1.50
U. S. Steel	New York	216½	193½	203½	Au. 29, Se. 28 Q	1.75
U. S. Steel, pfd.	New York	143½	141½	143½	Au. 5, Au. 30 Q	1.75
Virginia I. C. & C.	New York	20	20	20	Jan., 1924	1.50
Virginia I.C.&C., pfd.	New York	42	41	41	Jl. 16, 1928 SA	2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	374½	300	350		
Alum. Co. of Amer., pf.	N. Y. Curb	107½	106½	107½	Mr. 15, Ap. 1 Q	1.50
American Metal	New York	65½	57	60½	Au. 21, Se. 1 Q	0.75
Amer. Metal, pfd., 6%	New York			126½	Au. 21, Se. 3 Q	1.50
Amer. Sm. & Ref.	New York	108	95	97⅜	Oc. 11, No. 1 Q	1.00
Amer. Sm. & Ref., pfd.	New York	136	135	135⅛	No. 1, De. 2 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	34	25⅜	27⅜		
Asbestos Corp	Montreal	4½	4½	4½	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	18⅜	17½	17⅛	De. 31, Ja. 15 Q	1.75
Consol. M. & S.	Montreal	370	315	325	Je. 29, Jl. 15 SA	6.25
De Beers Consol	New York			21	Jl. 23, Jl. 26 Q	0.96
Federated Metals	N. Y. Curb	33⅛	29	29½	Oc. 3, Oc. 11 Q	0.25
Freeport Texas	New York	43	33	39½	Oc. 15, No. 1 Q	1.00
Int. Nickel Can.	New York	51	41	45⅛	Au. 31, Se. 30 Q	0.25
Int. Nickel, pfd.	New York	120	120	120	Se. 28, No. 1 Q	1.75
Mayflower Assoc	N. Y. Curb	91½	70	74⅜		
Metal & Mining	N. Y. Curb	16⅛	8⅜	13⅜	Se. 21, Oc. 1	0.30
Newmont	N. Y. Curb	211⅛	160	194⅜	Se. 30, Oc. 15 Q	1.00
Patino M. & E.	New York	36⅛	27⅛	34⅛	Au. 31, Se. 28 A.s.	0.97
So. America G. & P.	N. Y. Curb			2		
Texas Gulf Sulphur	New York	67⅛	55	63⅛	Se. 2, Se. 16 Q	1.00
U. S. Sm. R. & M.	New York	45⅛	35	41⅛	Oc. 7, Oc. 15 Q	0.87½
U. S. Sm. R. & M., pfd	New York	53½	50⅛	52⅛	Oc. 7, Oc. 15 Q	0.87½
Vanadium Corp	New York	77⅛	60	71⅛	Nv. 1, De. 16 QX	1.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I Initial. R, Respumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. A.s., American shares.

LONDON QUOTATIONS—WEEK ENDED October 15, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell ($25)	60/—	57/6	60/—	Nov., 1926	4 p.c.
Aramayo Mines (25 frs.)	55/—	53/9	55/—	Aug., 1929	5 p.c.
Burma Corpn. (10 rupees)	18/6	17/7½	18/1½	July, 1929	9 annas*
Bwana M'Kubwa (5s)	32/3	26/3	29/9		
Camp Bird (2s)	2/2½	1/10½	2/—	April, 1928	16⅔ p.c.
El Oro (5s)	3/—	2/7½	3/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£1)	6/10½	6/10½	6/10½	Jan., 1929	3½ p.c.
Mexican Corpn. (£1)	15/3	14/3	14/6	Oct., 1929	10 p.c.
Mexico Mines of El Oro (£1)	4/4½	3/9	3/9	Dec., 1926	3⅛ p.c.*
Mount Isa (£1)	35/—	33/9	33/9		
N'Changa Copper Mining (£1)	58/1½	52/6	53/9		
Oroville Dredging (4s)	1/9	1/9	1/9	Nov., 1928	31½ p.c.
Rhodesian Congo Border (£1)	191/3	176/3	182/6		
St. John del Rey (£1)	17/3	16/6	17/—	April, 1929	7½ p.c.
San Francisco Mines (10s)	37/6	36/—	37/3	June, 1929	15 p.c.
Santa Gertrudis (£1)	10/4½	9/9	9/9	July, 1929	7½ p.c.
Selukwe (2s. 6d.)	7/3	5/9	6/—	April, 1917	6¼ p.c.
S. Amer. Copper (2s)	2/9	2/3	2/3	Nov., 1917	75 p.c.
Tanganyika (£1)	57/4½	54/—	55/—	July, 1929	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	11,090	10,800	10,825	April, 1929	300 fr. (‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation.